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MACHINERY

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Coating by Molten-metal Spraying

Developments in Coating Either Metallic or Non-Metallic Parts with Any Metal to Obtain Protection Against Atmospheric Corrosion or Chemical Action

"Putting on" Tool for Reclaiming Spoiled Machine Parts, Increasing Dimensions or Weight, and Filling Blow-holes or Other Cavities in Castings

By RICHARD L. BINDER, President, Metals Coating Co. of America, Philadelphia, Pa.

A PROCESS of coating metals or other materials by spraying molten metal against the surface to be coated was described in September, 1914, MACHINERY. Since the publication of that article, there have been so many important developments and new applications of this process in various branches of the metal-working and other industries that a review will be given covering the latest forms of apparatus and some of the typical, as well as more unusual, operations.

This sprayed molten metal process in its present development does not differ in principle from the original one, but new forms of apparatus have been devised and the range of work to which it is particularly adapted is being extended continually. This expansion into new fields is largely due to the fact that it is possible by means of a very simple apparatus to apply an exceptionally durable coating of any commercial metal upon any other metallic or non-metallic surface. Thus, any of the non-ferrous metals can be applied to ferrous metals, or this order may be reversed. Metallic coatings may also be applied to non-metallic materials, such as wood, stone, brick, glass, porcelain, concrete, leather, and fabrics. The thickness of the coating may be varied, according to requirements, from 0.001 inch up.

Method of Spraying Molten Metal on Surface to be Coated

The metal to be deposited upon a surface is used in the form of ordinary commercial wire if the standard apparatus is used. For some special purposes, metal dust or powder may be used instead of wire by employing a different form of apparatus, but this method is used to a very limited extent, and hence need not be described here.

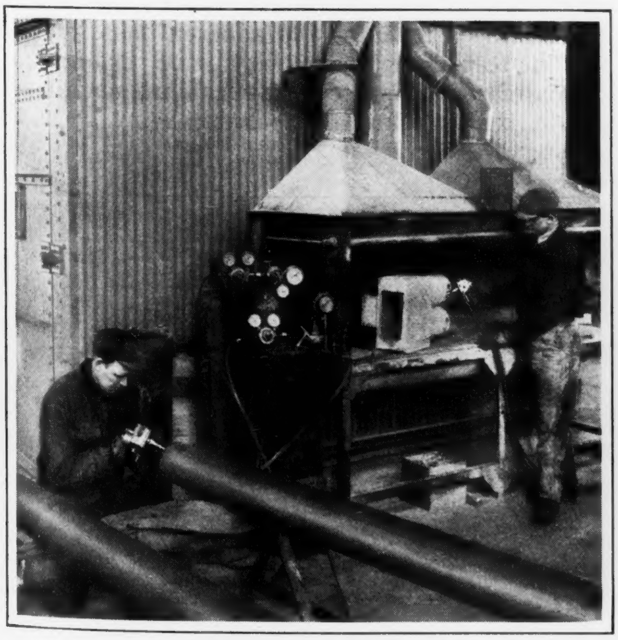


Fig. 1. (Left) Enlarging End of Worn Shaft; (Right) Use of Stand and Exhaust Hood for Coating Parts which are Brought to the Spraying Tool

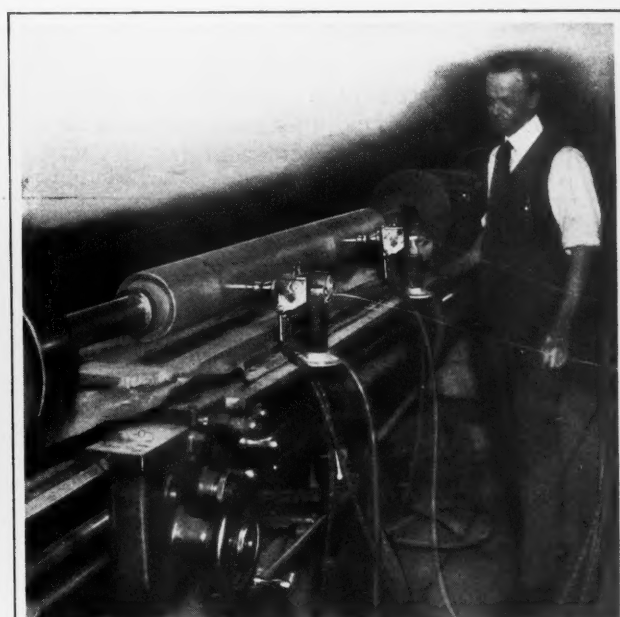


Fig. 2. Use of Two Metal Spraying Tools in Conjunction with Lathe for Copper-coating a Cast-iron Roll 5 Feet Long

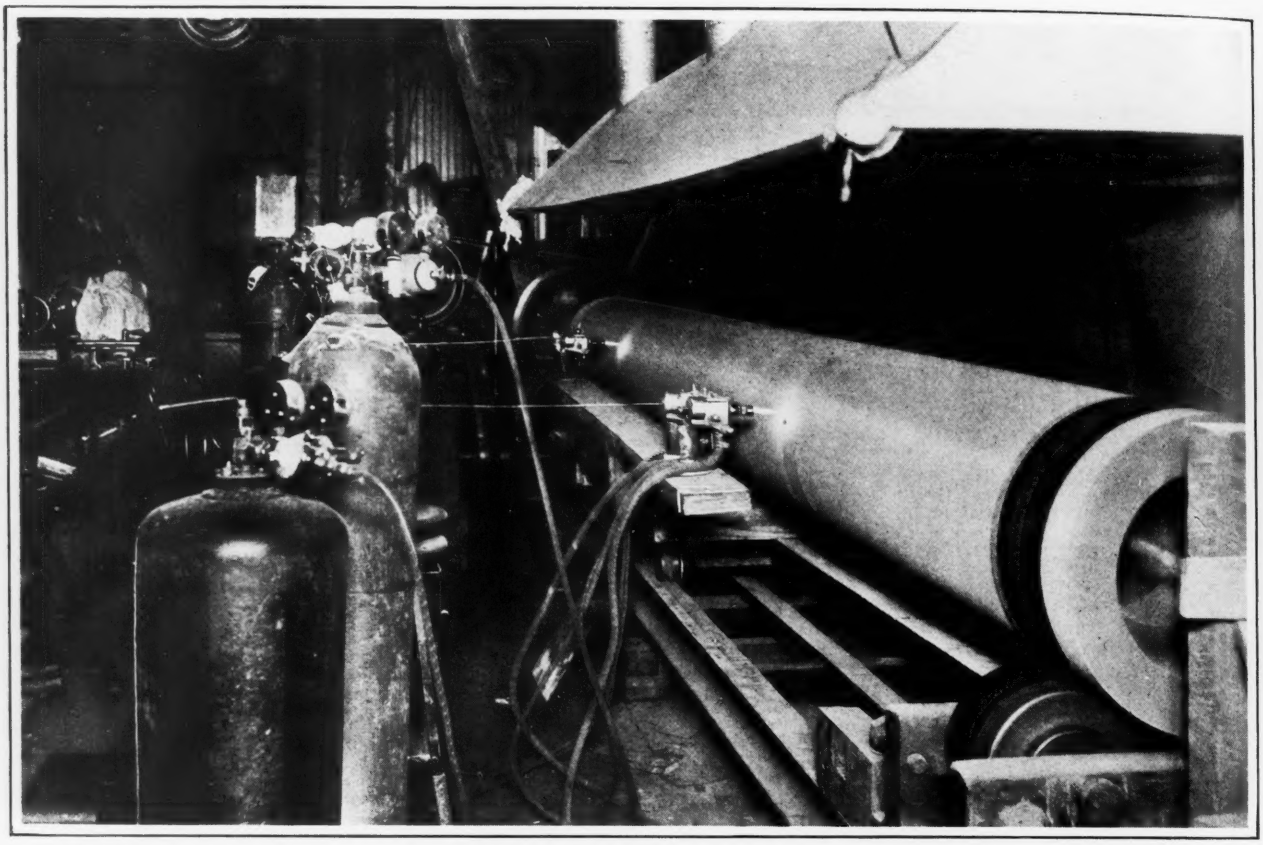


Fig. 3. Applying Copper Coating to Cast-iron Hydraulic Press Ram 14 Inches in Diameter and 16 Feet Long

The heading illustration shows the small tool or torch used in connection with wire. The wire, which may be seen entering the tool at the rear, is fed automatically from a reel through the nozzle and into contact with an oxy-acetylene flame which melts the wire and, in combination with compressed air, blows the atomized metal against the surface being coated at a velocity of about 3000 feet per second. The metal, as it impinges against the surface at this high velocity, solidifies and practically becomes an integral part of the surface, as indicated by the fact that it cannot be separated from it either by severe hammering or bending tests.

This tool or torch, which is known as "Metalayer," is connected by a rubber hose to standard acetylene and oxygen cylinders and also to a supply of compressed air. The tool contains a compact wire feeding mechanism, which is rotated by a small air turbine through suitable reduction gearing. This feed mechanism pulls the wire from the reel and feeds it through the nozzle at a rate varying usually from twelve to twenty-four feet per minute, depending upon the kind of metal used in coating.

The wire remains unaltered and nearly cold until it reaches a point about 3/32 inch beyond the nozzle. At this point the wire enters a reducing flame, and the minute particles of the molten spray are protected against oxidation so that layer after layer may be deposited, if desired, the entire coating forming a coherent and adherent mass. About 15 cubic feet of each gas is consumed per hour and approximately 50 cubic feet of compressed air per minute, the pressure of the latter being about 50 pounds per square inch.

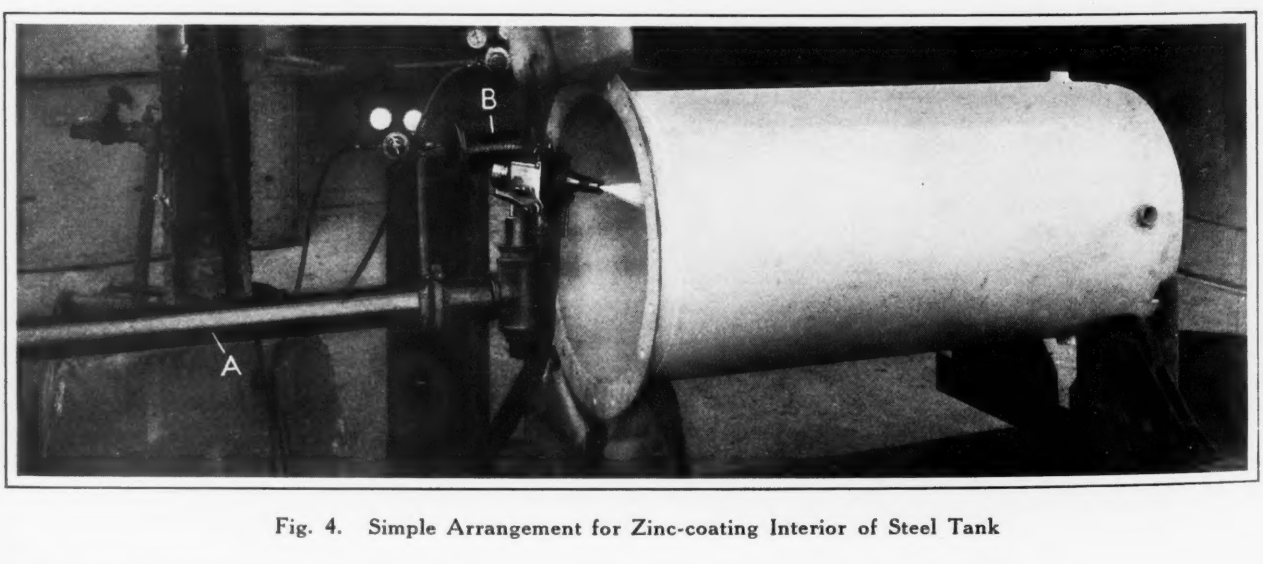


Fig. 4. Simple Arrangement for Zinc-coating Interior of Steel Tank

Fig. 5. Large Engraved Carpet Printing Roll Having Defective Spots in Copper Coating Deposited by Electroplating

How Metal Spraying Tool is Applied

This metal spraying tool weighs only 3 1/2 pounds, and is manipulated by hand for most work, although for some purposes it is guided mechanically, as will be illustrated by examples to follow. The parts to be sprayed are first sand-blasted to obtain a clean open-grained surface. Then the surface is coated by merely holding the nozzle 3 or 4 inches from it and moving the tool about sufficiently to cover the entire area. In starting a new piece of work, the wire feed is adjusted by turning a small needle valve which controls the flow of air to the turbine wheel. This adjustment must be such that there is the proper balance between the feeding movement and the rate at which the wire is melted, but this is readily obtained.

In coating comparatively small parts in a shop equipped for this purpose, the work is placed beneath an exhaust hood, as shown at the right in Fig. 1. In many cases, particularly in coating large structural members, etc., the tool must be taken to the work, and this may readily be done, whether in the shop or out in the field. For example, the operator seen at the left in Fig. 1 is enlarging the worn end of a very heavy steel shaft. For an operation of this kind, nickel wire ordinarily would be used, although it might be preferable to employ iron wire or steel wire of low carbon content. The usual procedure to follow on work of this type is to enlarge the shaft beyond the desired dimension and then finish it to size either by turning or grinding.

Coating or Enlarging Cylindrical Parts

Every machinist has heard the old joke about a "putting on" tool, but "Metalayer," or the metal

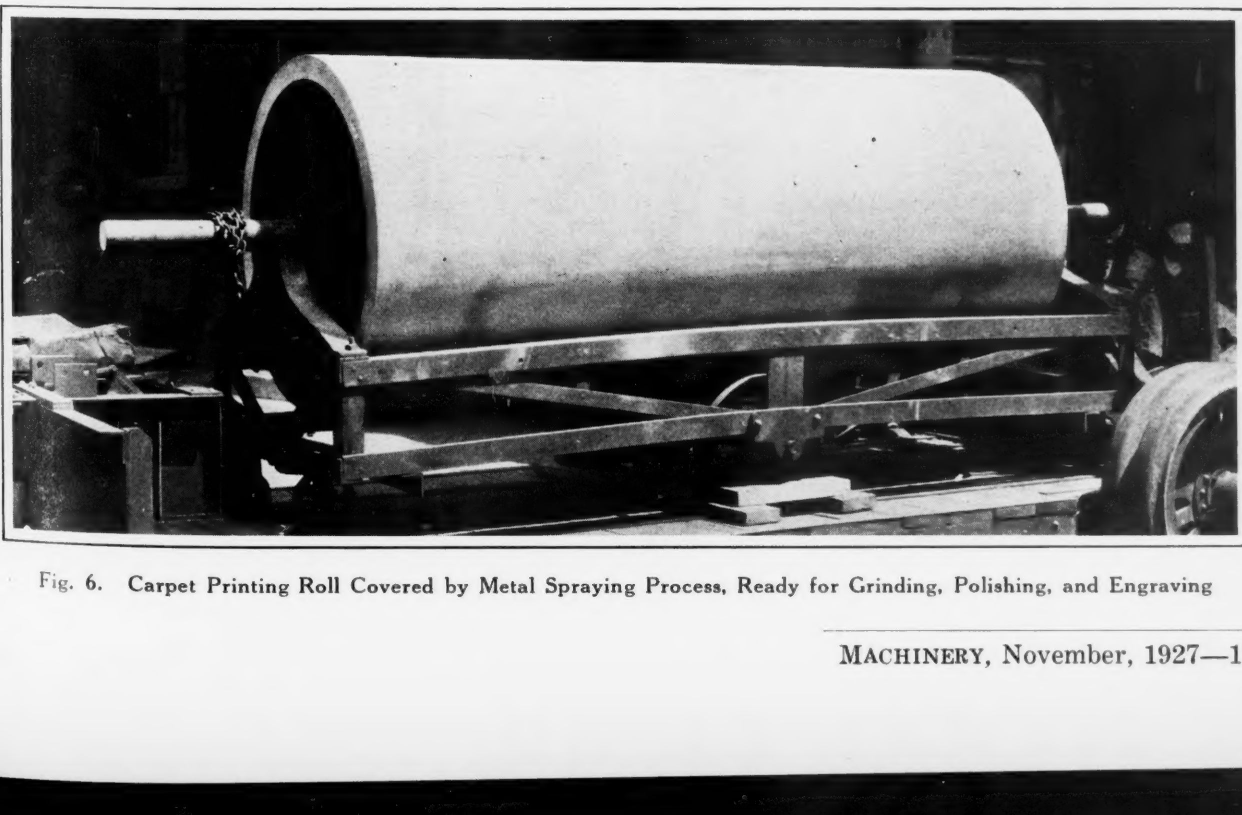


Fig. 6. Carpet Printing Roll Covered by Metal Spraying Process, Ready for Grinding, Polishing, and Engraving

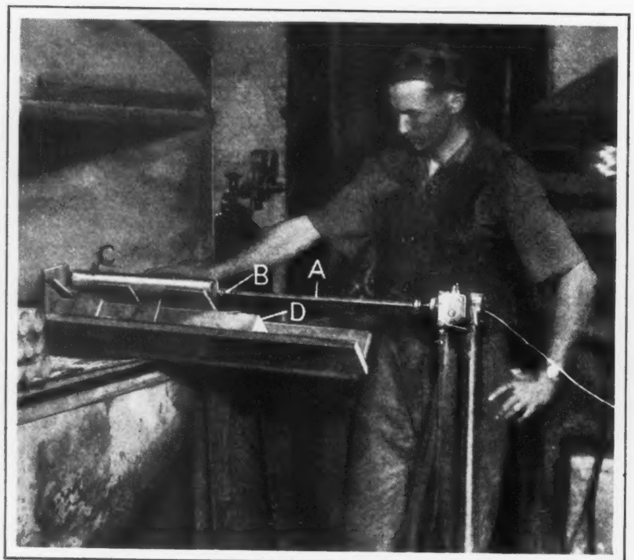


Fig. 7. Copper-coating Interior of Glass Tube

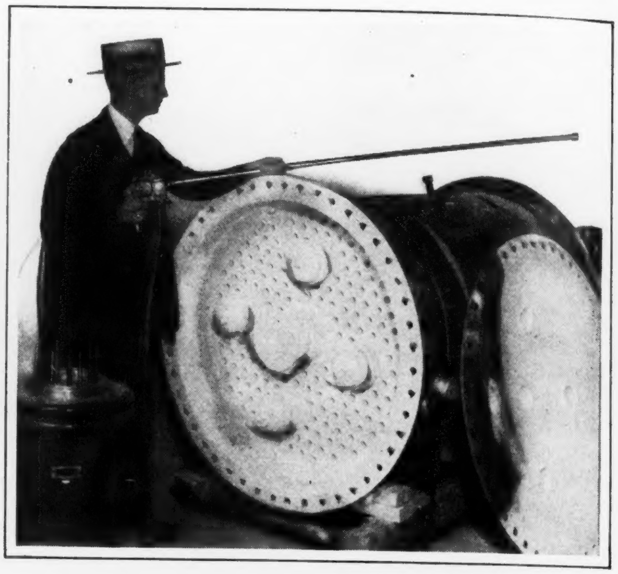


Fig. 8. Aluminum-coating Condenser Tubes 5 Feet Long

Fig. 9. Machine for Coating Small Parts in Bulk

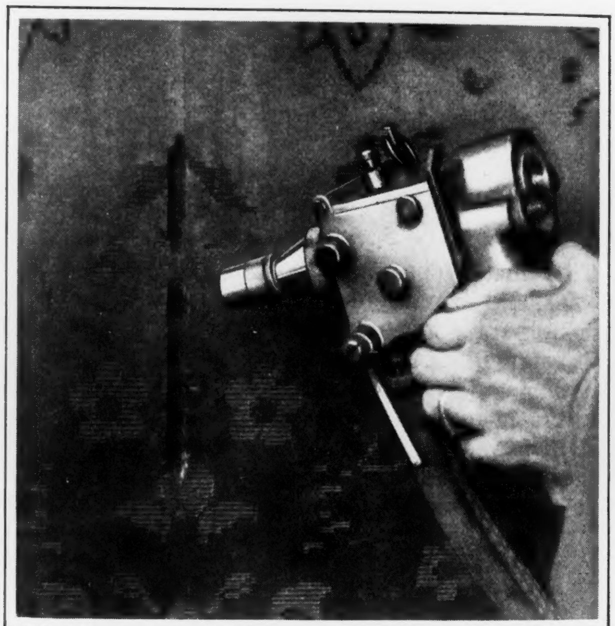


Fig. 10. Scored Carpet Printing Roll before Filling

Fig. 11. Portable Equipment for Zinc-coating Rail Ends

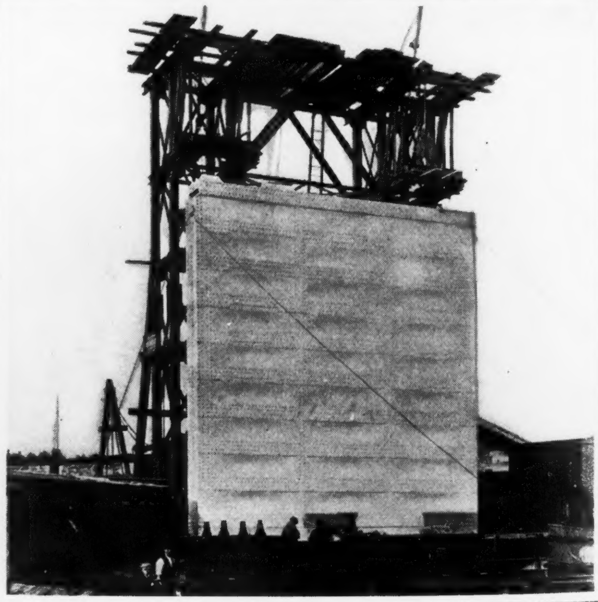


Fig. 12. Lock Gate, Zinc-coated by Metal Spraying

spraying tool, is in reality a "putting on" tool, as it may be used in the lathe for actually turning parts "up" or making them larger instead of turning them "down."

For enlarging cylindrical parts, the work may be placed between lathe centers and revolved while a "Metalayer" is traversed lengthwise by the lathe carriage, in the same way that a turning tool is used. This "putting on" process may be, and frequently is, applied also to flat surfaces which are below size, the usual method in such cases being to traverse the tool by hand until a layer of the desired thickness has been deposited.

Another important application in the case of cylindrical parts consists in applying a coating of some metal, such as copper, to withstand chemical action or corrosion, the coating in this instance being primarily for protection rather than as a means of enlargement.

Fig. 2 shows how two tools are used in conjunction with a lathe for applying a copper coating to a cast-iron roll. In this particular case, the length of the roll exceeded the capacity of the lathe between centers, so that two lathes, placed end to end, were employed. The two tools or torches are supported by a board attached to the carriage of the lathe, and each tool is so located that it covers half of the cylinder as the carriage is traversed half the cylinder length. This roll is 5 1/2 inches in diameter, 5 feet long, and has 7.2 square feet of copper-coated surface. The deposit of copper is 3/16 inch thick, the diameter being increased 3/8 inch. The time for depositing this copper, which weighed nearly 59 pounds, was about thirty-nine hours.

Fig. 3 shows another cylindrical coating operation, the work, in this case, being a cast-iron ram for a hydraulic press. This ram has a diameter of 14 inches, a length of 16 feet, and weighs 9000 pounds. The wall thickness is such that it was not considered feasible to apply a bronze bushing, as the thinness of the bushing made such a plan impracticable, but as the illustration shows, a coating of copper may readily be applied by the metal spraying process after means have been provided for revolving the roll and traversing the "Metalayer" tools along it.

Owing to the length of this roll, which greatly exceeded the capacity of the largest lathe in the shop, it was necessary to provide a special mounting and means for driving. The makeshift rig, although temporary, is entirely satisfactory. The roll is supported directly upon roller or disk bearings at each end, and it is revolved through a chain and sprocket drive from the lathe spindle. Two pairs of "Metalayer" tools are used, each pair being arranged to act as a single tool and thus double the depositing rate. The distance between the pairs of tools is equal to half the ram length, and the tool carriage connects with an ordinary leather belt passing over two pulleys, one of which is rotated through reduction gearing.

The tools move about 3/4 inch per revolution of the ram, and a coating of copper 3/32 inch thick is deposited, the diameter being increased 3/16 inch. A No. 20 gage copper wire is used. The size of the wire, however, depends upon the melting point of the material. For example, in depositing lead, a 13 gage wire would be used.

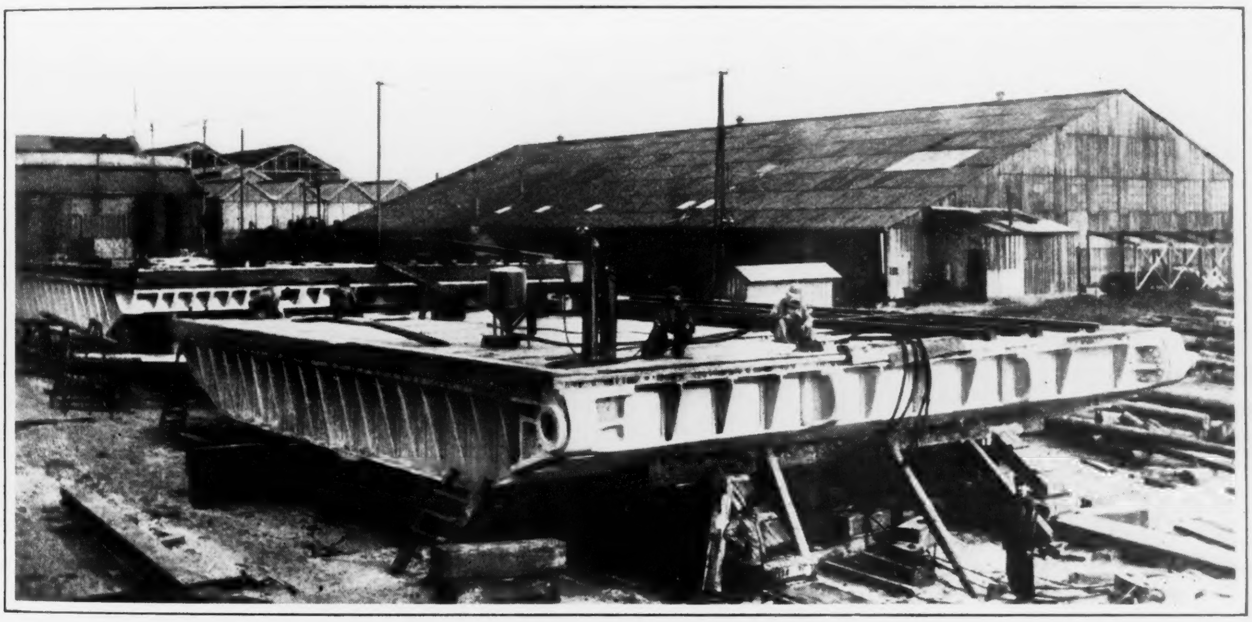


Fig. 13. Zinc-coating a Large Dock Gate by Metal Spraying Process

Coating Inner Surfaces of Tubes

The interior surfaces of tubes, even though small and of considerable length, may be coated readily by using a special internal attachment in conjunction with the "Metalayer" tool. This attachment consists of an extension having a rotating nozzle at the end, the length and size of the extension depending upon the tube diameter. Equipment for coating the inner surface of glass tubes used for electrical work is shown in Fig. 7. The extension *A* has a rotating nozzle at *B*, so that as tube *C* is pulled over the nozzle by block *D* along the temporary guide provided, the interior surface is completely covered.

Fig. 8 shows a condenser having tubes 5 feet long, which were coated internally with aluminum by using the equipment illustrated. The extension in this case was passed through the tubes by hand

and held in a central position by a small collar. This view shows clearly the reel and coil of wire from which the tool automatically obtains its supply of metal.

A much larger interior coating operation is illustrated in Fig. 4. The part, in this case, is for a hot water heater. This steel cylinder was coated with zinc, but because of its size, a standard "Metalayer" tool was used instead of employing the revolving nozzle. The tool is attached to shaft *A*, supported by a horizontal slide at the left (not shown) which carries the shaft and tool through the cylinder, a mechanical feeding mechanism being used to move the slide along its bed. Each time the tool traverses the length of the cylinder, the latter is rotated slightly to present a new surface to the spray. It will be noted that the coil of wire *B*, in this case, is supported by an arm attached to shaft *A*, so that it moves with the tool.

Coating Small Parts in Bulk

When comparatively small pieces are to be coated in bulk, a mass coating machine is used in conjunction with the "Metalayer" or coating tool. (See Fig. 9). This machine is somewhat like a tumbling barrel in that it has a power-driven rotating member which turns the mass of parts over and over, continually presenting new surfaces to the "Metalayer" tool. This tool may be held in a fixed position as shown, or for certain classes of work, it may be preferable to give it a slight oscillating movement to insure more thoroughly coating all surfaces.

This mass coating machine is intended for small parts weighing from a fraction of an ounce up to about 10 pounds, and these are placed in the barrel in lots of about 100 pounds each. The coating operation may, if desired, be followed by ball polishing or polishing with leather scrap. Spring tempered parts are not affected by the coating process, and the deposit on work handled in this manner is not thick enough to necessitate rethreading parts.

Some General Applications of the Metal Spraying Process

It will be evident from the foregoing that it is impracticable to give even a partial list of the applications of this process, since it may be applied in many branches of the mechanical and electrical industries, as well as in various other industries. However, the examples already referred to and the few that follow have been selected from a large number to indicate the wide range of work to which this process is applicable and its possibilities in numerous other directions.

Fig. 5 shows a carpet printing roll. A layer of copper 5/8 inch thick was deposited on this cast-iron roll by the electroplating process. Six months was required to obtain this thickness, which was necessary to provide for re-turning and re-engraving the roll when worn. This roll became defective in spots only, and it was very desirable to repair these local defects, owing to the expense of re-turning and re-engraving the roll. Fig. 10 shows how the "Metalayer" tool was used for this purpose. The scored or defective parts were merely chipped out somewhat to remove the bad metal, and these grooves were then filled by depositing a layer of sprayed copper, after which a small amount of finishing and engraving made the printing roll again serviceable.

A further development is shown by Fig. 6. As the "Metalayer" process proved so successful in repairing the old roll, it was decided to use the same process in producing a new one. A deposit of sufficient thickness to permit the design to be engraved on it was obtained in four days, the plan being to remove this deposit and recoat the roll when the design became obsolete, instead of turning it to a smaller size.

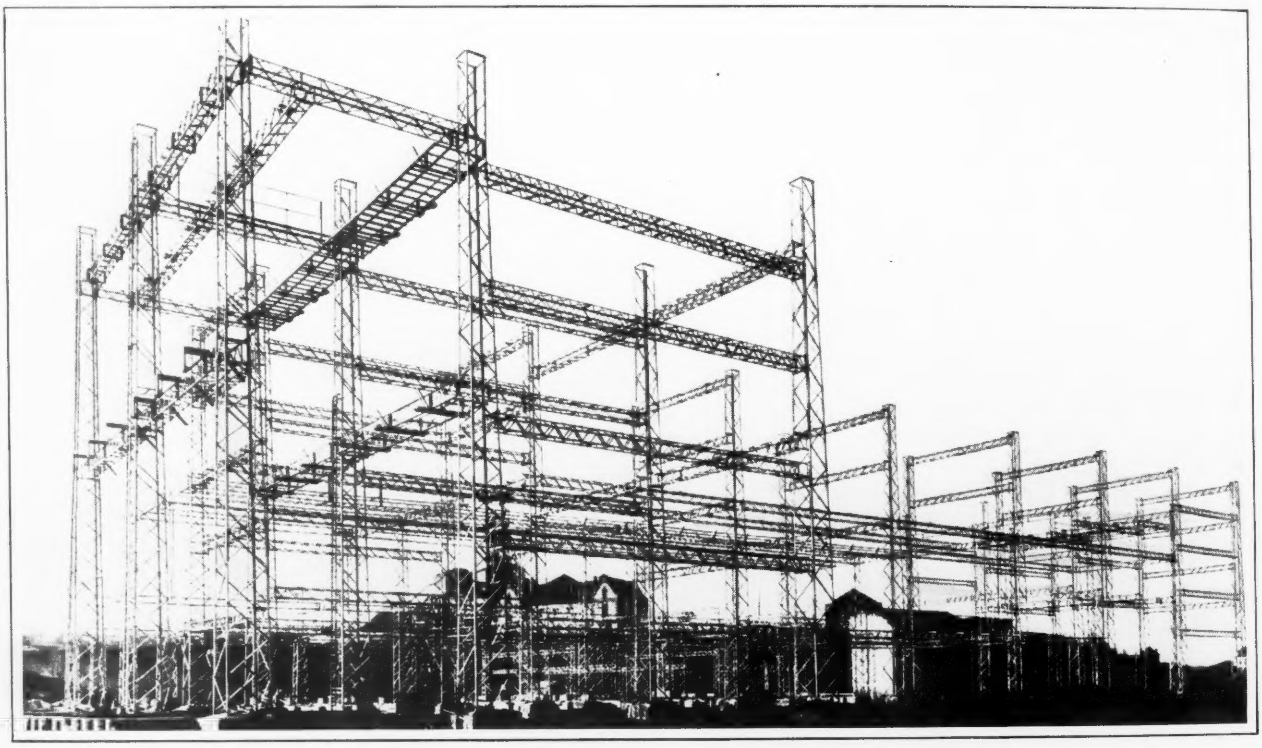


Fig. 14. Large Transformer Station Zinc-coated by Metal Spraying Process

Fig. 11 shows how the "Metalayer" process has been used for bonding rails. A coating of zinc is deposited both on the rail ends (in the field) and on the fish-plates (in the shop), so that a copper bond is unnecessary. A self-contained portable outfit is used for the rail ends, as illustrated.

Two examples of very large work are shown in Figs. 12 and 13. In Fig. 12 is shown one of the lock gates for the St. Denis Canal in France, and in Fig. 13 a dock gate that was coated by the metal spraying process. The size of these gates will be understood by comparison with the men in the illustrations. The lock gate, Fig. 12, is 55 feet high, 35 feet wide, 8 feet thick, and it has been covered with a zinc coating. One important advantage of a protective coating such as is applied by this process is that it covers not only the flat surfaces, but all rivet heads and joints as well.

The last example, Fig. 14, is a transformer station which has been given a zinc coating by the metal spraying process. It is estimated that the steel framework will be protected for about fifteen years. Since it was unnecessary to provide for corrosion losses, comparatively light steel has been used, and it is claimed that the saving in steel alone, practically paid for the coating process. In doing work of this kind, the various members are coated before assembling, and then, after erection, the work is completed by coating all rivets used in holding the main sections together.

This process may be utilized for filling blowholes or other defective places in either gray iron, steel, or non-ferrous castings. Another application of considerable interest is the coating with aluminum of parts subjected to high temperatures to prevent oxidation and scaling. Tests, for example, with coated and uncoated grate bars have proved that the coated bars are much more durable and also remain free from clinkers. The aluminum coating process is applicable to many other parts that must repeatedly withstand high temperatures, and their durability has in some instances been increased as much as 100 times.

The coating of various metallic parts to protect them against corrosion or the action of chemicals represents a very common application. For work of this kind, the metal used in coating may be selected to meet the conditions in each case, and if experiments are needed to determine the best metal, they can readily be made.

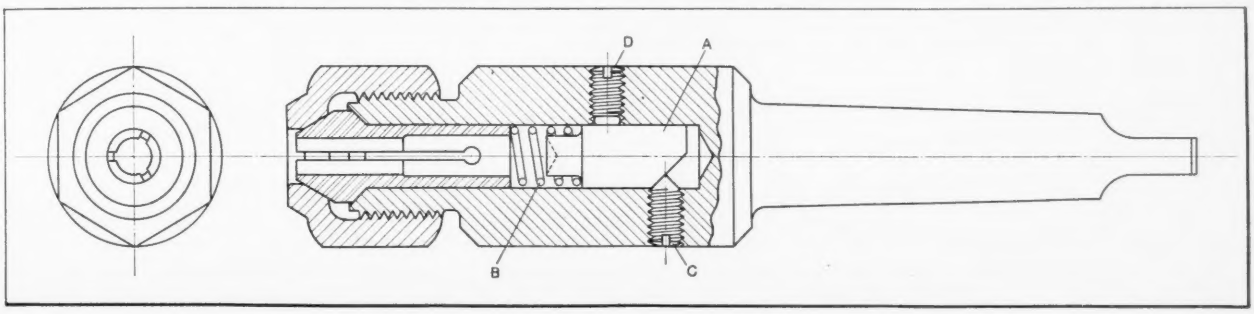
Although only a few of the many possible applications of this process have been referred to, it is believed that the examples selected illustrate both the practical value and the limitless field to which the metal spraying process may be applied.

COLLET CHUCK WITH ADJUSTABLE STOP

By LEWIS SKEEL

The chuck shown in the accompanying illustration is of the spring collet type commonly used on multiple drill heads. The special feature of interest is the adjustable plunger or stop *A* for locating the drill. The hole that receives the shank end of the collet was deepened to provide space for the plunger. The spring *B*, placed between the plunger and the collet, keeps these members separated. The plunger has a beveled surface which conforms with the conical point on the screw *C*. When screw *C* is turned to the right, the plunger is moved toward the collet. The plunger may be locked by tightening screw *D*. There is a copper disk under the point of screw *D* which prevents marring the surface of the plunger.

The drills used in the multiple-spindle drilling head should be divided into groups, the length of the drills in each group not varying more than the adjustment range of the plunger *A*, which takes the thrust of the drill. The conical recess in the end of the plunger assists in holding the drill in a central position. After the drill is placed in the chuck, the amount it extends from the chuck may be adjusted by screw *C*. The setting is then locked by tightening screw *D*. The collet nut is tightened to grip the drill in the usual manner.



Collet Chuck with Adjustable Stop for Locating Drill

* * *

SAFETY OF COMMERCIAL AIR LINES

The safety and reliability of properly managed air transportation was emphasized by L. B. Seymour, chief engineer of the National Air Transport, at a recent meeting of the Cleveland Section of the Society of Automotive Engineers. Mr. Seymour stated that airplanes operated by the National Air Transport, carrying mail between Chicago, Ill., and Dallas, Tex., a distance of about 1000 miles, had flown nearly 700,000 miles without the loss or damage of a single letter. No serious accident has occurred, and no person has been injured. An average of one forced landing has occurred for each 8500 miles flown.

* * *

STEEL TREATERS' SHOW IN 1928

The tenth national metal exposition held under the auspices of the American Society for Steel Treating, 4600 Prospect Ave., Cleveland, Ohio, will be held during the week of October 8 to 12, 1928, at the Commercial Museum in Philadelphia, Pa., where 75,000 square feet of space is available for exhibition purposes.

Do You Know How Steel Wool is Made?

Several Thousand Steel Strands are Cut Simultaneously from Small Wire by Almost Six Hundred Tools

By J. K. WILLIAMS, President, International Steel Wool Corporation, Springfield, Ohio

J. K. Williams, Who has been Engaged in the Manufacture of Steel Wool for Twenty-seven Years

ASK the average mechanic how almost any article of everyday life is made and he will be able to describe the manufacturing process fairly well. But ask him how the steel wool used by nearly every housewife is produced and his conceptions will be found to be vague. Many persons think that steel wool is a by-product composed of lathe turnings from fine machining operations, but such turnings would not meet the requirements of high-quality steel wool nor would it be possible to obtain from this source the tons of wool necessary to meet market demands. This article will describe to the readers of MACHINERY the methods used by the International Steel Wool Corporation, Springfield, Ohio, in manufacturing a product having the qualities of toughness, sharpness, and uniformity. This company has devoted over twenty-five years to the development of machinery for producing a high-grade quality of steel wool.

Manifold Uses of Steel Wool

While steel wool is commonly associated principally with household uses, it has many other applications. It is extensively employed in furniture factories, for instance, for rubbing down wood and varnished pieces. Steel wool is also used in the pressing machines of tailor shops, in laundry machinery, in air and gas filters, etc. Rugs have been made from it for service in laundries and other wet places. Steel wool is also used as a binder in asbestos and in rubber treads.

One of the most important requirements of good quality steel wool is toughness. The tougher the wool, the longer it will last, provided the edges are sharp. The sharper the edges, the better the steel wool will cut, unless oil has been used excessively in its manufacture, and has not been removed. In that case, the wool will slide over a metal or wooden surface almost as easily as a cloth over glass. Uniformity of the strand thickness is another desirable property, and is particularly necessary with wool used for such operations as rubbing down varnished furniture. As an example, if a fine grade of wool containing a few coarse strands were used for this purpose, the coarse strands would scratch and mar the finish. High grades of wool are hard to pull apart, whereas poor grades separate readily.

Steel wool has been on the market for more than twenty-five years and is now considered practically a household necessity, but little concerning its manufacture has been known, even to engineers. This dearth of information concerning the manufacture of so common an article has been due entirely to the great secrecy that has prevailed in the steel wool industry. MACHINERY is the first periodical to give its readers a comprehensive account of the ingenious methods by which steel wool is made. These methods are so entirely different from any used in other branches of the metal-working field as to be of unusual interest.

Hundreds of Tools Shave One Wire Simultaneously

In the machines used exclusively for producing steel wool in the plant of the company mentioned, wire is drawn from a large spool and carried continuously around the machine by grooved drums. The tools are arranged on both sides of the machine in vertical rows. Each tool shaves the wire in the same plane, and when the wire leaves the machine its cross-section is that of a circular segment. Groups of the individual strands of wire are gathered together and drawn as a ribbon or rope from the machine by rollers. As it leaves the roller devices, the wool resembles carded sheep wool in feel and also in appearance, except for color.

More than one grade of wool can be produced from a machine at the same time by providing different tools, so as to cut strands of different size, and then drawing all strands of the same size into one ribbon. The strands are triangular in shape, the greatest height of the triangle ranging from 0.0075 to 0.012 inch, with the different grades. Human hands do not touch the wire from the time it enters the machine until the scrap leaves it.

About fifteen miles of wire are run through a machine per nine-hour day. In weight, the average production of steel wool per machine, with two operators, is 220 pounds per hour, as against 1 1/2 pounds with the process used twenty years ago. Before the present continuous one-way process was adopted several years ago, the reversible process was employed in which the wire is reciprocated

back and forth between the tools. The principal claim made for the new process is a much higher quality of wool, having about four and one-half times the strength of the previous product. The increased strength is attributed to the fact that the wire is always shaved with the grain instead of across it.

Ribbons or ropes of wool could be produced continuously, miles long, if this were desirable. The illustration gives a good idea of the strength and continuity of a ribbon 20 feet long. Most wool is cut up into bunches weighing either one pound or one ounce by girls or automatic machines. These bunches may be packed loosely into boxes for the market or first pressed into compact pads.

The wire has an unusually high tensile strength which enables it to be pulled under the shaving tools until it has been cut away to a small percentage of the original diameter. The wire is stretched taut under the tools and around the drums, but the load on the wire at any point is not very heavy, because the pull is divided between each portion of the wire that comes in contact with either drum. The wire rarely breaks while in the machine, but when it does, the broken ends are merely welded together again. There are thousands of feet of wire wound around the drums and on the spools at one time. Four different speeds are obtainable, and so the wire may be fed at a similar number of speeds.

Tools Used for Making Steel Wool

Serrated tools are used. At each end, the tool is machined away to an angle of about 30 degrees to provide sufficient clearance to permit the steel wool to leave the tool on as straight a line as possible. When there is insufficient clearance, the wool breaks easily. Grooves are cut on both sides of the tool, so that the tool may be merely turned end for end in the machine, when the first side used requires resharpening.

Triangular steel wool strands are cut, because of the serrated cutting edges of the tools, and more than one strand is produced by most tools, due to the fact that several of the cutting vees are in contact with the wire. Each tool is so mounted in a holder that the cutting edge is held at right angles to the wire instead of truly vertical. Thumbscrews on the holder permit of increasing or decreasing the pressure of the tool on the wire. All the machines that are used in this plant are covered by patents.

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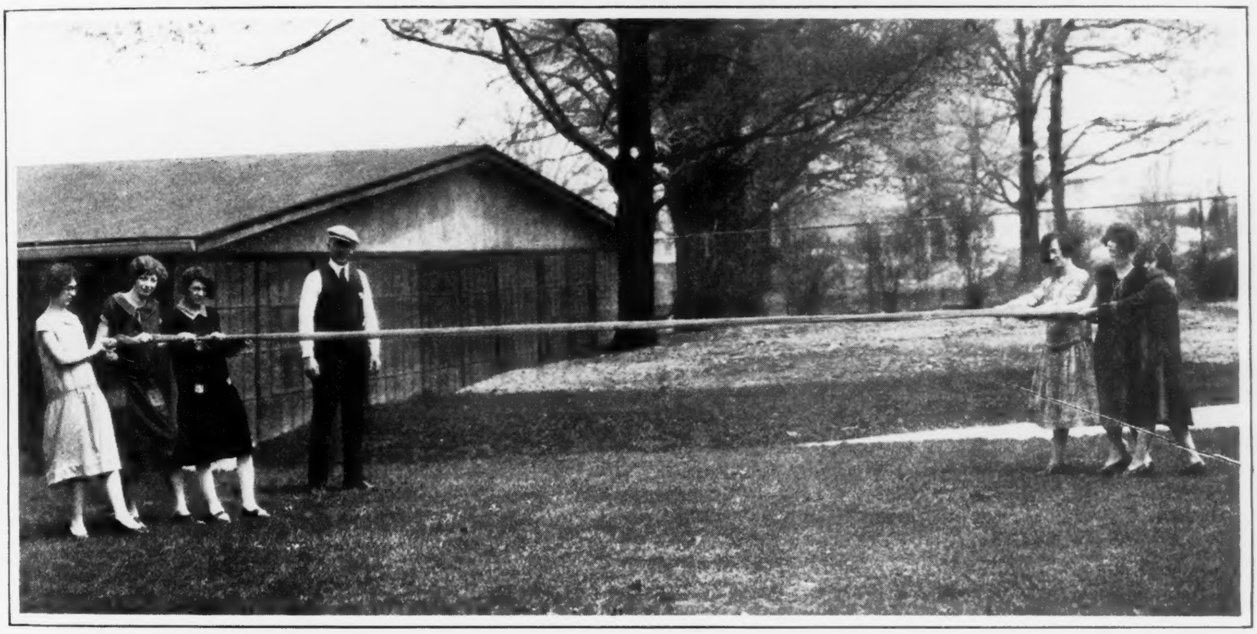


Twenty-foot Rope of Steel Wool Used in a Tug-of-war without Breaking, Showing not only the Strength but also the Continuity of the Strands

EFFICIENCY OF LARGE AND SMALL PLANTS COMPARED

According to a study of the comparative productivity of plants of different sizes, made by the National Industrial Conference Board, large plants —that is, those that have an annual output valued at a million dollars or more—are by far the most efficient in the utilization of labor. It is interesting to note, however, that during the period 1919 to 1923 the medium-sized plants, particularly those with an annual output ranging from $20,000 to $500,000, had gained in labor utilization efficiency in a greater ratio than either the groups producing over a million dollars worth of goods a year or those producing less than $20,000 worth of manufactures.

The production per worker in plants with an annual output of from $1,000,000 upward in 1923 was, according to this analysis, $1481 for every $1000 worth produced by workers in plants with less than a million dollars worth of annual output. Thus the output per man in the larger plants was 48 per cent greater in that year than the production per man in smaller plants.

It is pointed out that the production figures quoted, while significant, are valid only as regards the production per worker in all the plants considered, and are not applicable in appraising the efficiency of any one individual plant. It is evident that there may be small plants that are highly efficient, while there are some large plants that are notoriously inefficient.

What MACHINERY'S Readers Think

Contributions of General Interest are Solicited and Paid for

DEMAND FOR MECHANICAL ENGINEERS

I read with considerable interest the item "The Demand for Engineering Graduates" on page 941 of August MACHINERY. With the demand so much greater than the supply, it would seem that a larger number of young men would turn to mechanical engineering as a life work. Perhaps one of the reasons why they do not is that, on the whole, the mechanical engineer is not so well paid for his work as men engaged in the sales and business departments of engineering firms.

The mechanical engineering courses at our universities are not easy, and it takes boys of great determination and ability to conclude their engineering studies satisfactorily. After they have graduated, their studies are by no means completed, but they have to keep themselves posted continuously on new developments. Their education is never finished, they are not free when they leave the office, and they have little time for golf and other pastimes. In view of what is demanded of the mechanical engineer, he is probably entitled to a somewhat higher rating on the industrial salary scale; and until he receives better compensation, it is likely that there will be a scarcity of competent engineers as compared with the demand.

OBSERVER

THE DESIGNER'S REAL JOB

The most important development in our mechanical age is the design of machines in which the skill and even the intelligence of the individual worker is transferred from the man to the machine. Without such transfer of skill, present-day mass production would be impossible. Neither machine designers nor machine users realize exactly what they are doing when they design or use a machine. It is not always obvious to them that all that has been done is to transfer skill in performing an operation to a mechanism of iron and steel.

The designer should always ask himself if there is any amount of skill or intelligence required in performing a certain operation that could be transferred to a machine. If production requirements are analyzed from this point of view, there would be more intelligent designing effort, and much of the present haphazard work would be eliminated. The designer would have a definite objective which he now often lacks. It is true that he gets his job done anyhow, because he is really carrying out the principle of transferring skill to the machine without consciously thinking about it, but he should be able to do a still better job if he had this principle clearly in mind.

The writer believes that if we could get all the mechanical industries to obtain a clear conception of what they are actually doing, it would help to clear up much obscure thinking. There are many who still believe that the main causes of the increased production of the present age are "division of labor" and "application of power," but these two items are merely incidental to the more fundamental principle of the machine age—the transfer of skill and intelligence from men to machines.

E. F. DB.

PERSPECTIVE DRAWINGS AS AN AID IN LOCATING PARTS AND PATTERNS

The most common method of designating machine parts and patterns is by the use of numbers, it being good practice, whenever possible, to have the part numbers run consecutively. It is part of a stock clerk's duties to familiarize himself with these numbers, so that he can readily locate the part wanted.

While this is good, the method is not without confusion, for it is found, in practice, that small parts are often kept in bins, while the medium sized parts are put in piles or boxes in another part of the store-room, and the large parts of the machine, such as the bases or frames, are often kept in the yard. Unless one is very familiar with the parts, much time is wasted in looking for the part wanted. This also applies to the storage of patterns, and here the clerk is often at a loss to know what the pattern looks like when he is merely supplied with a number and required to find the pattern.

In order to readily convey an idea of a pattern's shape to the stock clerk, so that he may have some idea of what he is looking for, it has been found to be a good plan to make free-hand perspective sketches, on one sheet of paper, of the various parts used for any one type of machine. The arrangement can be any suitable one, although it is preferable that the numbers be consecutively arranged, where convenient. The perspective drawing should also contain general over-all dimensions.

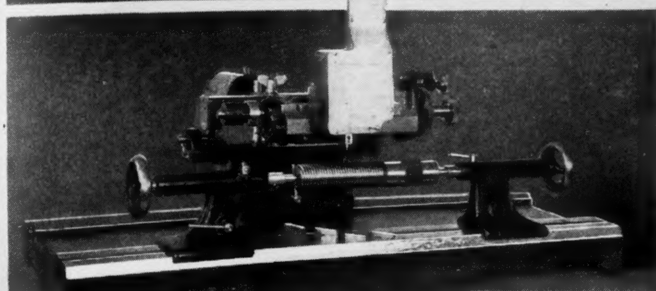
F. SERVER

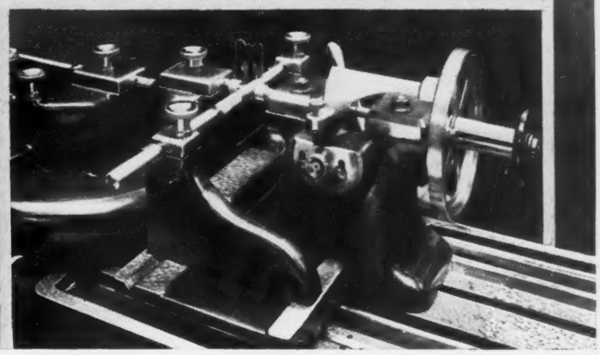
* * *

ST. LOUIS MEETING OF THE A. S. M. E.

The first national fuels meeting, held under the auspices of the Fuels Division of the American Society of Mechanical Engineers and the St. Louis Section of the Society October 10 to 13, proved to be of unusual interest to engineers who are especially concerned with fuels and combustion. Nearly thirty papers were read at the different sessions, by men whose professional standing vouched for the value of their contribution to the knowledge of the subjects dealt with. Special industrial as well as power plant sessions were held, while general sessions dealt with subjects of general interest to all users of fuels. Two sessions were devoted to smoke abatement.

Devices for Thread Measurements





Methods and Equipment for Accurately Gaging Tap Threads

By A. L. VALENTINE, Manager, Tap and Gage Division, S K F Industries, Gothenburg, Sweden

THE previous installments of this series of articles have discussed the design and construction of different types of taps, with special reference to taps having ground threads. This installment will deal with the methods and devices used for accurately measuring tap threads.

An extremely important matter to be considered during the manufacture of precision tools, such as ground thread taps, is of course, the measuring of the thread dimensions, first, during the different stages of manufacture, and second, during the inspection of the finished product. The available instruments that have been found most practical will be briefly dealt with. It should be emphasized that in quantity production of ground taps, it is not only necessary to have accurate machines, appliances, and apparatus, but that these should also be so simple and easy to manipulate that a workman with ordinary skill can make use of them without undue loss of time.

There are many thread-measuring devices of both American and European manufacture that are very accurate, but that are not suitable in a quantity production plant, because they require workmen of more than ordinary intelligence to operate and read them, and also because altogether too much time is needed for set-ups and adjustments and for taking readings. Expensive production machinery and operators often stand idle in the meantime. The accuracy of some devices for which high claims are made is also questioned, because it is impossible for two persons to obtain the same reading, or even for the same person to obtain the same reading twice.

There are many instruments on the market for measuring the lead of screws which are also claimed to be suitable for taps, a claim which is not always correct. On the other hand, there are several devices that meet the requirements. One that the author has found very practical, simple, and rapid for factory use was devised by the late B. M. W. Hanson of the Hanson-Whitney Machine Co., and was illustrated and described in August, 1923, MACHINERY, page 946. An improved type of the same measuring machine was illustrated and described in January, 1925, MACHINERY.

On this measuring device, a view of which is shown to the left in the

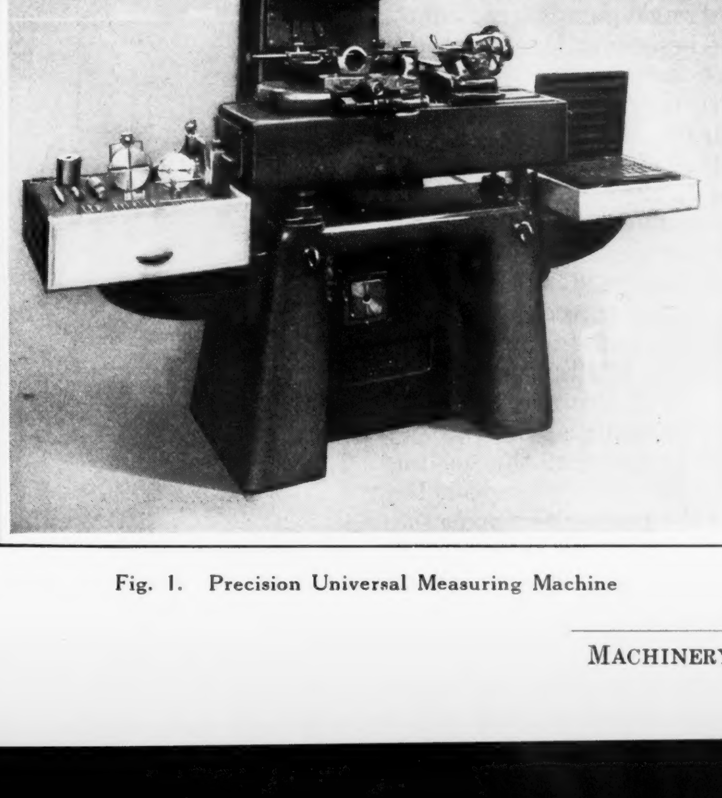


Fig. 1. Precision Universal Measuring Machine

heading illustration of this article, the scale is graduated so that one may read off dimensions as close as 0.0001 inch, but by using a magnifying glass, one-quarter of this amount, or 0.000025 inch, is easily estimated. The device is strongly constructed and will not be injured by ordinary intelligent use. Friction is practically eliminated, and the device is extremely sensitive. There are other machines, particularly of European manufacture, that have a much wider range than the device referred to; but on account of the relatively long time required for setting up these devices and for taking readings, they become more laboratory instruments than practical shop measuring tools.

Another type of instrument—the light projector type—of which there are several makes, both American and European, is shown in Fig. 2. Instruments of this type are handy and practical for measuring screws, but in the case of taps the writer has not found them quite so suitable, owing to the fact that taps have flutes, sometimes spiral, and are relieved in the thread, provided with a back taper, and frequently have burrs on the thread surfaces at the time measurements must be

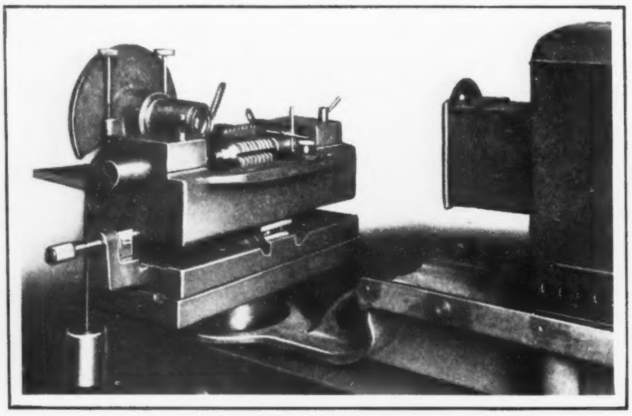


Fig. 2. Light Projector Type of Thread Measuring Instrument

made, as, for example, if measurements must be taken on a tap fluted after being threaded.

These instruments operate, in principle, about as follows: The shadow of the thread on the tap to be measured is compared with the shadow of the thread of a correct thread angle gage, thread chart, or thread plug gage. The projection apparatus throws the shadow of the thread of the gage on a master or screen on which the theoretically correct thread profile has been drawn. The shadow of the thread of the gage is adjusted to correspond with the master profile drawn on the screen, and is also adjusted to come between tolerance lines drawn on the screen, which indicate the tolerance permitted on the piece to be measured. The shadow of the tap threads, if the tap is correct, must coincide with the master profile and fall within the tolerance lines. Consequently, if a tap to be measured is placed in the holding device instead of the gage, its accuracy can be instantly ascertained.

On account of the fact that one of the holding members is generally threaded and placed on the side of the lens system of the projection apparatus, and a certain distance from the screen on which the thread is projected and measured, the enlarge-

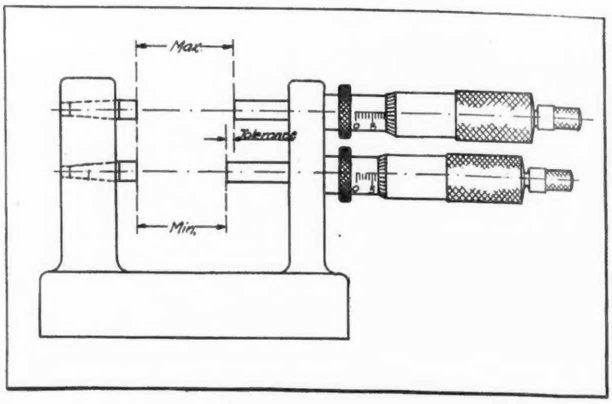


Fig. 3. Device Used for Measuring Tap Diameters Before Hardening

ment possible is very great, and even the slightest lead error can be detected. All unevenness and inaccuracy of the thread sides can also be easily detected with this apparatus. In the manufacture of taps it is necessary, however, to measure both diameter and lead before the taps are hardened, and as the threads at that time present many faults and are generally full of burrs from the fluting operation, the apparatus must be used with great care, because the slightest burr or dirt on the spot where the tap rests in the threaded holder will result in an incorrect reading.

Wickman Measuring Machine

An interesting and useful machine that will not only measure all dimensions of a tap within an error of plus or minus 0.00005 inch, but which will also measure other external and internal dimensions on plain, threaded, and tapered work, is shown in Fig. 1. This is known as the Wickman universal measuring machine, made by the English firm Alfred Herbert, Ltd. A view of the measuring part of the device is shown to the right in the heading illustration. All measurements made on this machine are referred directly to fundamental end standards, and are guaranteed to be correct within four times the error of the end standards. The machine is sturdy and can be used under ordinary shop conditions. Its accuracy is independent

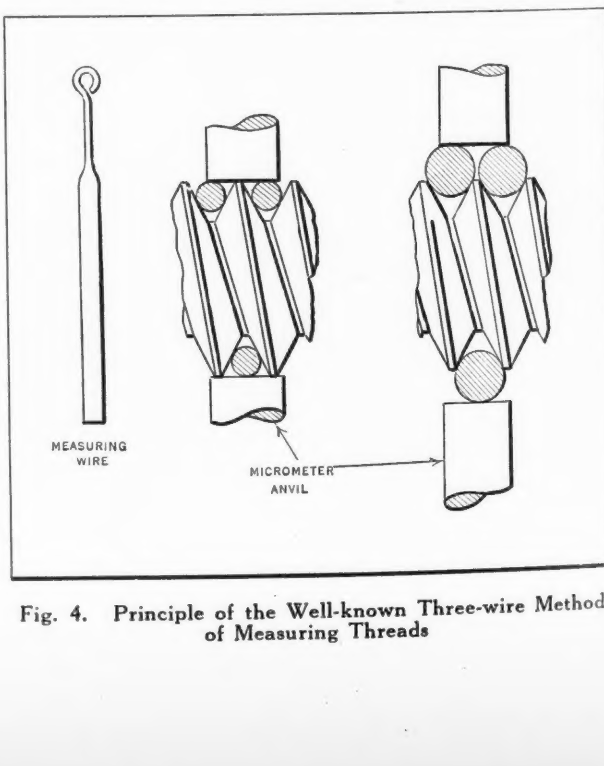


Fig. 4. Principle of the Well-known Three-wire Method of Measuring Threads

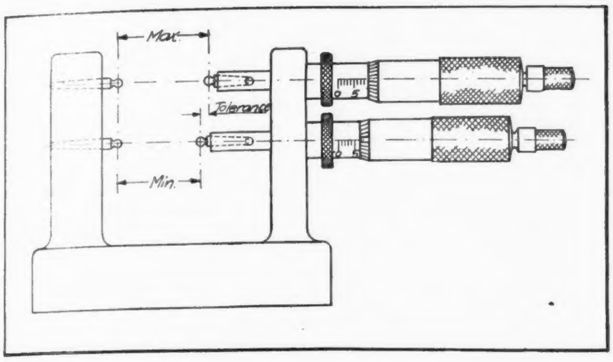


Fig. 5. Ball Micrometers Arranged for the Measurement of Pitch Diameters before Hardening

of the personal element, and its magnification is 5000 to 1, so that a variation of 0.00001 inch on the work produces an indicator movement of 0.050 inch, an amount easily seen. Lead errors are measured either with end standards for extreme accuracy, or by the use of a micrometer screw. When using end standards, lead measurements are guaranteed to be within plus or minus 0.00005 inch.

Instruments for Measuring Diameter Dimensions

For checking the different diametral dimensions of taps before hardening, only very simple measuring instruments are necessary. The outside diameter is measured with ordinary micrometers, one set to the maximum and one to the minimum diameter, held in a stand as shown in Fig. 3. For measuring the outside diameter while the work is in the machine during the threading operation, tolerance snap gages are used to advantage.

The outside diameter of a tap is generally considered of small importance so long as it is large enough. It is important, however, that the finished tap should not be too much over size, because the larger the outside diameter is, the more pointed will the tops of the threads be; and the more pointed they are, the less resistance will they offer to wear and heat during the tapping operation. The relief must also be carefully examined.

For measuring the relief on both the outside and the pitch diameter, and for measuring the actual outside and pitch diameters as well, an instrument

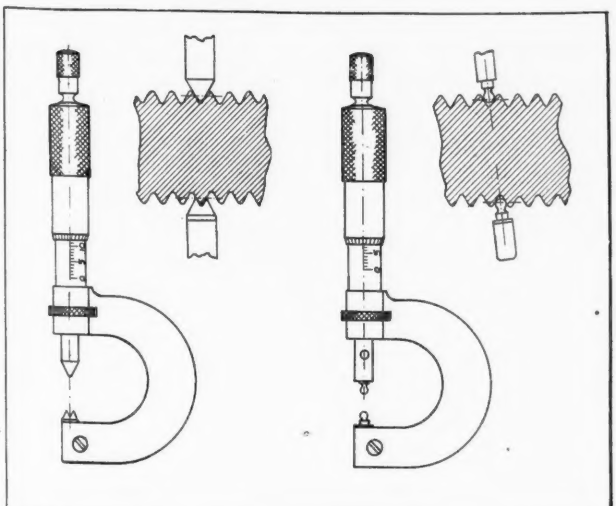


Fig. 6. Thread and Ball Micrometers as Applied for Measuring Pitch Diameters

has been constructed by the author which has proved practical and time-saving. This is shown in Fig. 7 set up for measuring pitch diameter and relief. The apparatus consists of a circular bed or frame on which are fastened two holders, one for a micrometer screw and one for a Hirth minimeter. Between these two holders is mounted a double slide, the lower part being movable sidewise on a ball slide, and the upper part movable lengthwise. On the upper slide are mounted the two centers between which the tap is held. The minimeter is set to zero by the micrometer screw, using a gage; the micrometer is then locked, whereupon the taps can be rapidly and accurately measured. The outside diameter, relief, and (by moving the slide lengthwise) back taper, can be easily determined.

Measuring the Pitch Diameter

Measuring the pitch diameter of a tap is somewhat more difficult. It is measured most correctly

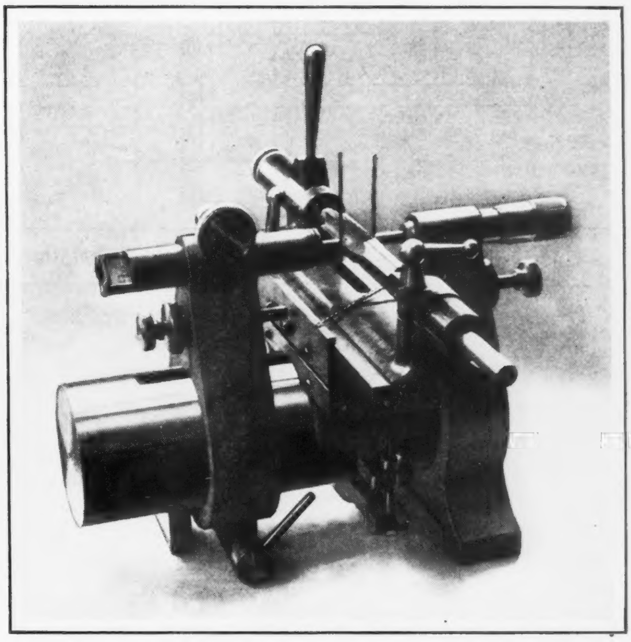


Fig. 7. Device Suitable for Measuring Outside and Pitch Diameter of Taps, as well as the Amount of Relief

by means of accurately ground cylindrical wires applied to the tap, as shown in Fig. 4, this being the well-known three-wire system by means of which the measurement can be taken over the three wires with an ordinary micrometer. By using wires of two different diameters, the angle of the thread may be determined as well, in a convenient and accurate manner. The wires used are ground to an accuracy of plus or minus 0.00002 inch.

As plain micrometers are not convenient for measuring the pitch diameter with wires and are often not sufficiently accurate, and as in using them it is necessary to handle and hold not only the micrometer but also the three wires, the instrument shown in Fig. 7 is used for this purpose as well. It will be observed that as the slide cannot be changed from its right angle in relation to the axis of the tap, it is not necessary to use more than one wire on each side of the tap (two in all, instead of the usual three), and this saves not only the expense of wires but also much time in handling.

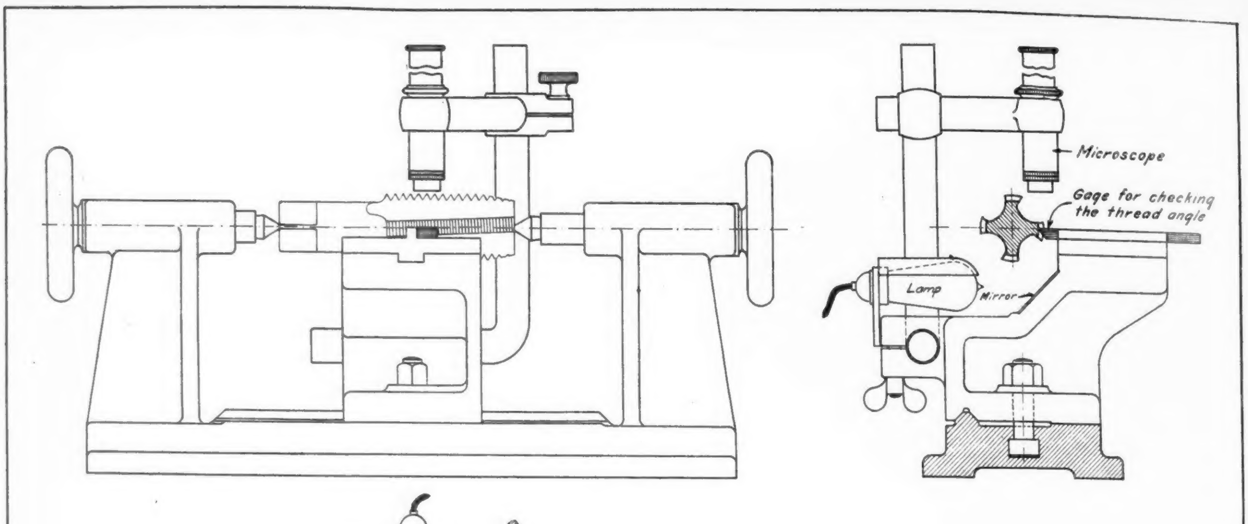


Fig. 8. Inspection Device for Determining that the Thread Angles are Correct in Size and Correctly Located

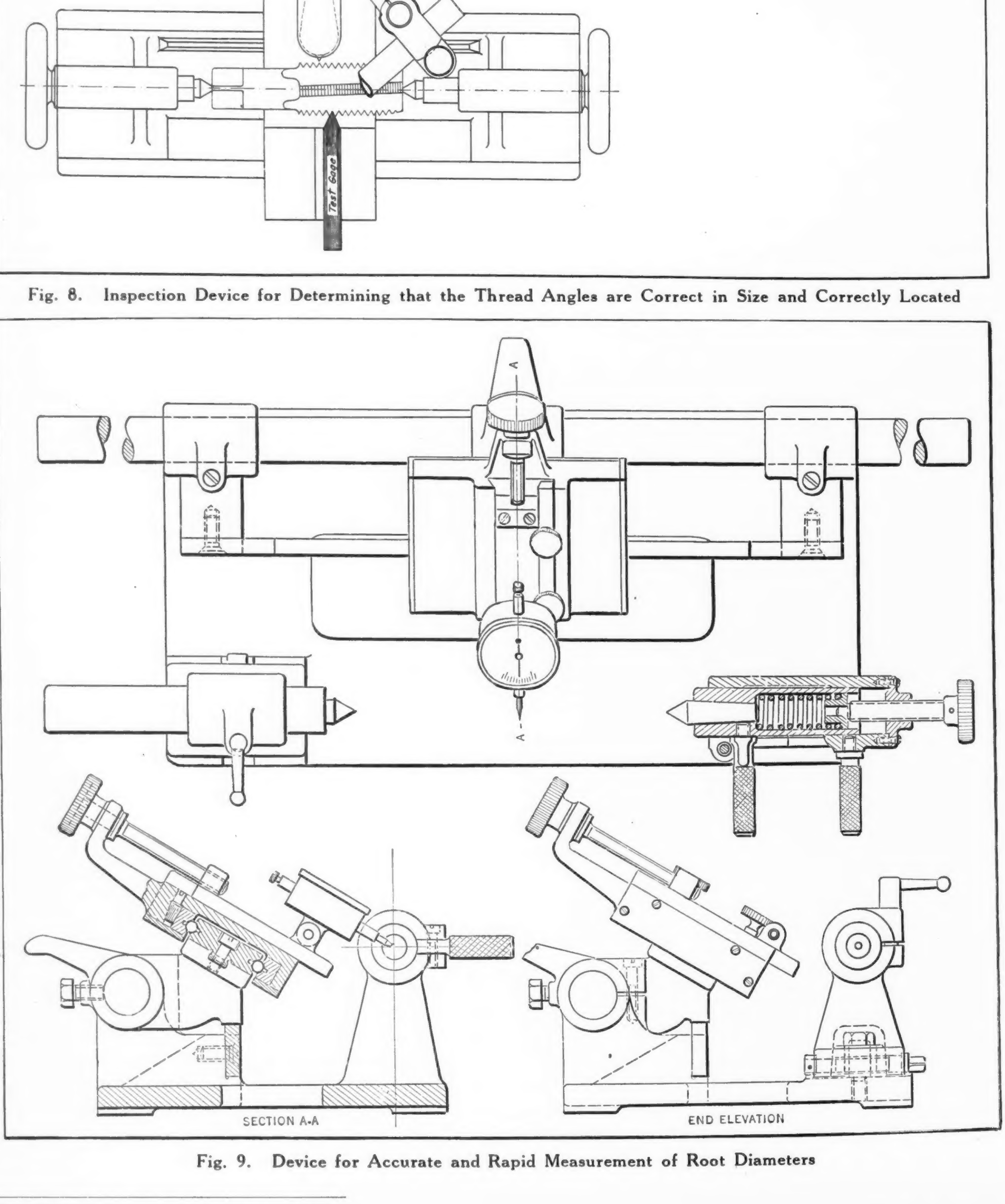


Fig. 9. Device for Accurate and Rapid Measurement of Root Diameters

The relief is inspected and measured by turning the tap around on its centers, and the taper, if any, by moving the slide on which the tap is mounted, lengthwise.

Thread micrometers (shown to the left in Fig. 6) are not recommended for such close measurements as are necessary when inspecting the pitch diameter of ground thread taps. This is also true of the so-called "ball" micrometers (shown to the right in Fig. 6), where the least wear or out-of-roundness of the rotating ball will result in incorrect readings. In measuring the pitch diameter of taps before hardening, when the measurements, on account of the finishing of the tap after hardening by grinding, need not be so accurate, thread and ball micrometers can be used to advantage. Tolerance snap gages are also suitable for this purpose. During the inspection of taps before hardening, the ball micrometer device shown in Fig. 5 has been found practical.

It should be noted that, in order that measurements of the pitch diameter taken as described shall be correct, the thread angle must be accurately located with regard to the axis of the tap, and the thread sides must be straight. Both of these elements can be easily and quickly checked by means of the apparatus shown in Fig. 8, where it will be seen that the tap is mounted between two centers. At right angles to these centers are mounted sliding gages, by means of which not only the inclusive thread angle and the straightness of the thread sides, but also the location of the thread angle with regard to the axis of the tap may be determined.

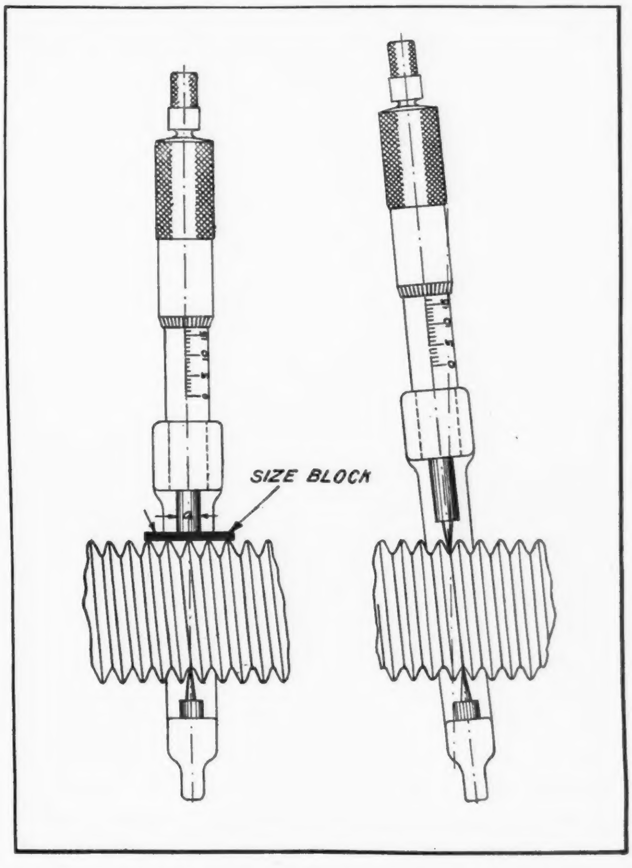


Fig. 10. Methods for Measuring Root Diameters

Measuring Root Diameters

The root diameter of taps is not of the same importance as the pitch diameter. It is easily and, for commercial purposes, correctly measured by means of micrometers, as shown in Fig. 10. It is, of course, necessary to make sure that the radius on the micrometer point that enters the thread is smaller than the radius in the bottom of the thread in the tap. The size-block shown in the view to the left in Fig. 10, is used only when the diameter *a* of the micrometer is less than twice the pitch of the thread, or when it is desired to obtain the correct root diameter directly without compensating for the lead angle of the thread on the tap measured. It is evident that if a micrometer with two points, as shown to the right in Fig. 10, is used, a correction must be made for the lead of the thread. However, the error caused by the lead angle of the thread is generally very slight and need hardly ever be taken into consideration in the case of taps.

If, however, the root diameter of a tap thread needs to be measured absolutely correctly, the apparatus shown in Fig. 9, which was constructed by the writer, serves the purpose in a satisfactory manner. The taps are quickly mounted in succession between the centers, one of which is a spring center. The dial indicator shown—a Hirth minimeter can be used instead for still more accurate measurements—is mounted on a ball-bearing slide which moves very freely in the longitudinal direction of the tap.

For taps manufactured in quantities, it will pay to use a plain plug gage, the diameter of which equals the root diameter of the tap to be measured, for setting the device. The indicator is then set to zero with this plug gage for each size of tap. The plug is then removed and the taps inserted in rapid succession between the centers, the errors in the depth of the thread being instantly read off on the indicator. To obtain the error on the root diameter, it is only necessary to multiply the readings obtained by 2.

For special taps made in small quantities, it is not necessary to make special root-diameter plug gages. A standard plain plug gage of any known diameter of a size near that of the root diameter of the tap to be measured can be used for setting the indicator, and by adding or subtracting, as the case may require, the difference between the plug gage used and the root diameter of the tap required can be determined. The instrument shown can easily be adapted for taking direct measurements without comparing with plug gages of known diameters, if the slide on which the indicator is mounted is provided with a dial and micrometer screw.

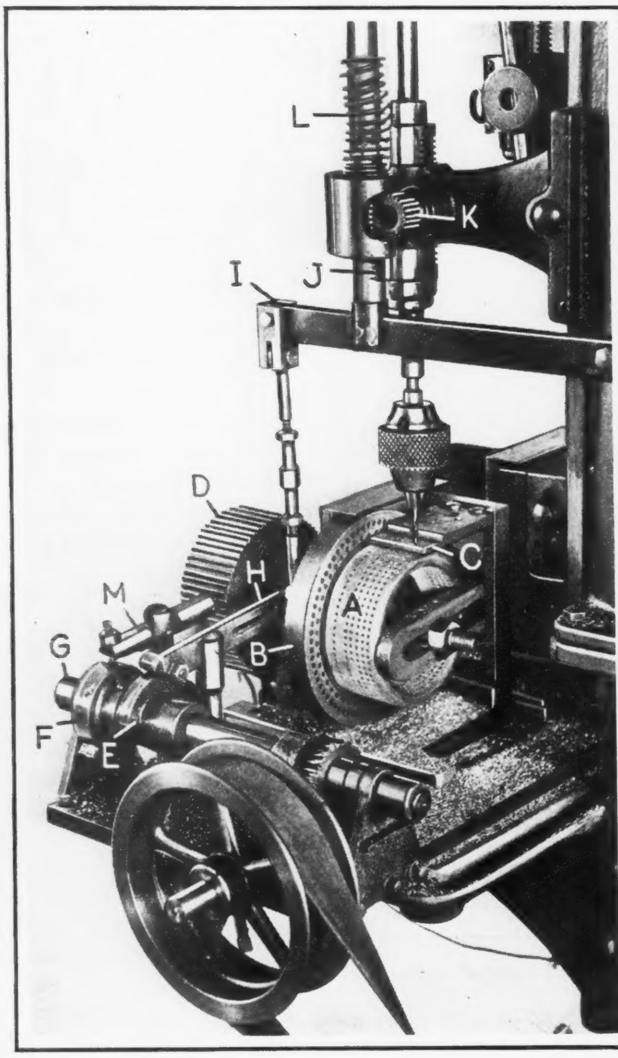
* * *

A new use for chromium plating has been found for stills used in oil refineries. These stills are made from steel. In the distilling operation of oil, they must withstand very high temperatures and pressures, and in use they deteriorate quite rapidly from corrosion. The life of these stills has been greatly increased by chromium plating on the inside. It has been found that the cost of the plating process is more than offset by the increased life of the stills.

DRILLING DOUBLE-WALLED BRASS SHELLS

By AVERY E. GRANVILLE

Double-walled brass shells or rings, such as shown at *A* in the accompanying illustration, are required in large quantities. These shells are made of 20-gage brass, have an outside diameter of about 5 inches, an inside diameter of 3 3/4 inches, and are about 3 inches wide. There are six rows of holes drilled around the shell. As there are 80 holes in each row and as the drill passes through both walls of the shell, the total number of holes drilled is 960. It is not essential that these holes be spaced with any great degree of accuracy, but they must be produced at a comparatively low cost. After various methods of punching the holes, multiple drilling, and a number of indexing schemes had been considered, the equipment shown was finally decided upon as being best fitted to meet the production requirements.



Automatic Indexing Fixture for Drilling Brass Shell

The special equipment was attached to an old sensitive drilling machine that had suffered so much shop abuse that it was no longer sensitive to anything that might be done to it. The construction of the device, which drills the holes in each row automatically, but must be set by hand for each separate row, will be best understood from a description of the operation. The shell *A* to be drilled is clamped to the indexing faceplate *B* by means of a stud and an ordinary horseshoe clamp. The different rows of holes in the index-plate are used for other shells in which the spacing of the holes is entirely different.

The drill is guided by a hardened steel plate *C*, provided with properly spaced guide bushings for the different rows of holes. On the same spindle with the indexing faceplate is the wide ratchet wheel *D*, used to turn the index-plate and the work. The ratchet wheel, the index faceplate, the work, the drill guide plate, and the bracket are all carried on a slide which may be adjusted in or out to bring the work and the drill guide bushing into alignment with the drill spindle. When one row of holes has been automatically drilled entirely around the shell, the slide is moved over to bring the work into the correct position for drilling the next row of holes.

As the indexing is not required to be extremely accurate, the indexing plate is locked at each position by means of a round-end spring-backed pin, which slips on the index-plate when the latter member is forcibly turned, but serves to hold the work in position while drilling. The automatic indexing of the faceplate and work and the automatic feeding movement of the drill are accomplished by means of two cams *F* and *E* secured to the worm-driven shaft *G*.

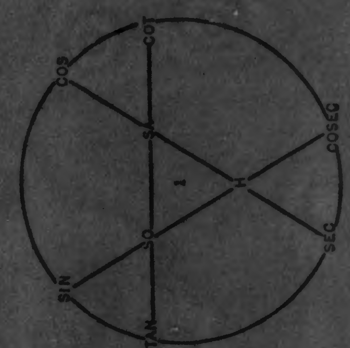
The end of lever *H* is moved upward by the gradual rise on the cam *E*. This movement causes the end of lever *I* to be drawn downward, which, in turn, pulls down the sleeve rack *J*. As rack *J* is connected by a long pinion *K* with a rack cut in the drill spindle, the drill is automatically fed into the work. A spring *L* serves to raise the spindle as soon as the end of lever *H* drops off the heel of cam *E*.

When the drill clears the work, the abrupt rise on cam *F* forces the end of lever *M* upward, so that the end carrying the spring-backed pawl is forced downward. This action turns the wide ratchet wheel *D* a distance sufficient to move the index-plate into position for drilling the succeeding hole. The ratchet pawl in lever *M* is merely a double pin set into a hole drilled in the end of the lever and backed by a helical spring. A small pin in the side of the pawl, working in a slot in the lever, keeps the pawl from turning while in use. There is a flat spring under the end of the lever that serves to keep it in contact with the surface of the cam.

With the parts properly set and the machine in operation, no attention is required until all the holes in one row have been drilled. No automatic stop is provided, but a buzzer notifies the operator when a row of holes has been completed, so that he can set the device for drilling the next row or change the work after all the holes have been drilled in the shell. The buzzer is operated by a pin in the outer side of ratchet wheel *D*, which comes in contact with a small flat spring that is insulated from the machine table and mechanism. One wire leading to the buzzer is connected with this spring and the other wire is connected with the drilling machine. The current for operating the buzzer is supplied by means of two dry batteries.

MACHINERY'S DATA SHEETS 117 and 118

CHART OF TRIGONOMETRIC FUNCTIONS



Rule 1—The center term equals the product of the two extreme terms of any three consecutive terms on either a straight or curved line.

Rule 2—Any extreme term equals the center term divided by the other extreme of any three consecutive terms.

Rule 3—The product of terms on the circle at opposite ends of a straight line equals unity.

Rule 4—Any term on the circle equals unity divided by the term on the circle at the opposite end of a straight line.

Abbreviations

Sin = sine; Cos = cosine; Tan = tangent; Cot = cotangent; Sec = secant; SO = side opposite; SA = side adjacent; H = Hypotenuse; 1 = unity; Cosec = cosecant

Rule 1	Rule 2		Rule 3 / Rule 4
Sin = Tan × Cos	$Sin = \frac{SO}{H}$	$Sec = \frac{H}{SA}$	Sin × Cosec = 1
Cos = Sin × Cot	$Sin = \frac{Cos}{Cot}$	$Sec = \frac{Tan}{Sin}$	Cos × Sec = 1
Tan = Sec × Sin	$Sin = \frac{Tan}{Sec}$	$Sec = \frac{Cosec}{Cot}$	Tan × Cot = 1
Cot = Cos × Cosec	$Cos = \frac{SA}{H}$	$Cosec = \frac{H}{SO}$	**Rule 4**
Sec = Cosec × Tan	$Cos = \frac{Sin}{Tan}$	$Cosec = \frac{Cot}{Cos}$	$Sin = \frac{1}{Cosec}$
Cosec = Cot × Sec	$Cos = \frac{Cot}{Cosec}$	$Cosec = \frac{Sec}{Tan}$	$Cos = \frac{1}{Sec}$
SO = Tan × SA	$Tan = \frac{SO}{SA}$	$SO = \frac{SA}{Cot}$	$Tan = \frac{1}{Cot}$
SO = Sin × H	$Tan = \frac{Sin}{Cos}$	$SO = \frac{H}{Cosec}$	$Cot = \frac{1}{Tan}$
SA = Cot × SO	$Tan = \frac{Sec}{Cosec}$	$SA = \frac{SO}{Tan}$	$Sec = \frac{1}{Cos}$
SA = Cos × H	$Cot = \frac{SA}{SO}$	$SA = \frac{H}{Sec}$	$Cosec = \frac{1}{Sin}$
H = Sec × SA	$Cot = \frac{Cos}{Sin}$	$H = \frac{SO}{Sin}$	
H = Cosec × SO	$Cot = \frac{Cosec}{Sec}$	$H = \frac{SA}{Cos}$	

MACHINERY'S Data Sheet No. 117, New Series, November, 1927 Contributed by Robert A. Kandler

STANDARD KEYWAYS FOR HOLES IN GEARS

Adopted as Recommended Practice by the American Gear Manufacturers' Association, May 12, 1927

Diameter of Holes, Inches	Standard Keyways			Special Keyways*		
	Width	Depth	Keystock	Width	Depth	Keystock
5/16 to 7/16	3/32	3/64	3/32 by 3/32	1/8	3/64	1/8 by 3/32
1/2 to 9/16	1/8	1/16	1/8 by 1/8	3/16	1/16	3/16 by 1/8
5/8 to 7/8	3/16	3/32	3/16 by 3/16	1/4	3/32	1/4 by 3/16
15/16 to 1 1/8	1/4	1/8	1/4 by 1/4	5/16	3/32	5/16 by 3/16
1 3/16 to 1 3/8	5/16	5/32	5/16 by 5/16	3/8	1/8	3/8 by 1/4
1 7/16 to 1 3/4	3/8	3/16	3/8 by 3/8	1/2	3/16	1/2 by 3/8
1 13/16 to 2 1/4	1/2	1/4	1/2 by 1/2	5/8	7/32	5/8 by 7/16
2 5/16 to 2 3/4	5/8	5/16	5/8 by 5/8	3/4	1/4	3/4 by 1/2
2 13/16 to 3 1/4	3/4	3/8	3/4 by 3/4	7/8	5/16	7/8 by 5/8
3 5/16 to 3 3/4	7/8	7/16	7/8 by 7/8	1	3/8	1 by 3/4
3 13/16 to 4 1/2	1	1/2	1 by 1			
4 9/16 to 5 1/2	1 1/4	7/16	1 1/4 by 7/8			
5 9/16 to 6 1/2	1 1/2	1/2	1 1/2 by 1			
6 9/16 to 7 1/2	1 3/4	5/8	1 3/4 by 1 1/4			
7 9/16 to 9	2	11/16	2 by 1 3/8			
9 1/16 to 11	2 1/2	13/16	2 1/2 by 1 5/8			
11 1/16 to 13	3	1	3 by 2			

*These sizes are suggested as special when conditions make it necessary to deviate from standard.

This table is also used for plain and gib head taper keys with a standard taper of 1/8 inch per foot. The depth shown is the deep end of the keyway.

A tolerance of plus 0.001 to 0.002 inch is recommended on keyways up to and including 1 inch wide, and plus 0.002 to plus 0.003 inch for keyways over 1 inch wide. Keystocks up to and including 1 inch have a tolerance of from standard to plus 0.0015 inch and those over 1 inch, from standard to plus 0.0025 inch. The tolerance on the depth for straight keyways shall be from standard to plus 1/64 inch; for taper keys, from standard to minus 1/64 inch. On heat-treated pinions, there shall be 1/32 inch clearance over the key with a tolerance from 0 to minus 1/64 inch, with 1/32 inch radius in the corners of the keyway. The depth of the keyways shall be measured at the edge, as shown in the accompanying diagram.

MACHINERY'S Data Sheet No. 118, New Series, November, 1927

CINCINNATI GRINDERS NEW SHOP

The arrangement of the new plant of the Cincinnati Grinders, Inc., at Oakley, Cincinnati, Ohio, represents a radical departure from the layout required for the customary method of manufacturing machine tools. The department system of manufacturing is followed, so that one type of product is made in one particular location of the shop. Hence, instead of having all lathes in one department and all milling machines in another, under the present method, each department in the plant where milling operations are required is supplied with the necessary number of milling machines. In actual operation, this plan has proved very satisfactory. The illustration above shows a general view of the main floor of the shop, which is served by two 60-foot span cranes of 15 tons capacity each, equipped with a 3-ton auxiliary hook for rapid handling of light work. A central aisle is provided, as this has proved to furnish the best facilities for shop transportation.

The new shop is provided with the latest machine tool equipment for accuracy and high production. Many special machines are provided, one of which is shown in the insert above. This boring machine was designed especially for drilling, boring, and reaming large grinding machine parts completely at one setting.

Current Editorial Comment

in the Machine-building and Kindred Industries

AN INDUSTRY TO BE PROUD OF

Hats off to the great industry represented at the exhibitions recently held in Cleveland and Detroit. Although many different products were shown, they all represent one great basic industry which supplies the equipment used in practically every line of metal manufacture.

Those fortunate enough to attend these exhibitions saw perhaps the greatest demonstration of mechanical progress known to industry. Almost every one of the 494 exhibitors at the two exhibitions showed some new and important development representing a valuable contribution to the art of manufacturing. And these remarkable improvements have been made by an industry which has been advancing with rapid strides for many years—an industry that refuses to stand still.

The manufacturing equipment of the war period seemed then to be the acme of development, but the originators and producers of that equipment set higher and higher standards of quality and performance and then proceeded to meet them. Builders of machine tools and other shop equipment move forward rapidly and continuously.

If it were possible to discover and record every element contributing to this progress, the composite history would reveal many costly experiments which the tool user knows nothing about, as well as many notable individual achievements. Such a history would also reveal how these developments have saved users of manufacturing equipment untold millions.

Where is there an industry which has contributed so much and asked for such a small return? Machines are continually being produced which pay for themselves in the user's shop in a few months, but their builders are not content; they begin new experiments and invest large sums in their attempts to further reduce unit costs. And so we say, hats off to every man engaged in producing the "Master Tools of Industry."

* * *

HARDENED STEEL WAYS ON MACHINES

When the slide of a machine frequently moves back and forth on the ways over a comparatively short distance, as in many machines used for turning, hardened steel ways have been found to be a great improvement over soft cast-iron ways. The latter wear at too rapid a rate, especially when the cooling compound and fine chips find their way between the slide and the ways. When the ways wear down in machines equipped with a turret or other tool-holding device, the alignment is lost between the work-holding spindle and the tools. The result is inaccurate and unsatisfactory work.

On one machine, cast-iron ways wore down 1/16 inch in three months and the user found it necessary to face the ways with hardened steel strips. These strips wear very slowly, but should it ever become necessary to replace them, this can be easily done. Some machines on the market are now provided with hardened steel ways, and this method of construction has been highly commended by some production executives.

* * *

THE MACHINE TOOL CONGRESS

The first steps in the organization of what will be known as the Machine Tool Congress were taken at the Cleveland Exposition in September, the object being to provide an opportunity for builders and users of machine tools to discuss problems of mutual interest. At the meeting held in Cleveland the keynote of the discussions was standardization, and it is expected to hold meetings in the future whenever special opportunities occur for bringing together a large number of machine tool users and manufacturers, such as future machine tool expositions.

The discussions planned will fill a need in the machine shop practice field, as formerly the only opportunities for direct exchange of opinions and information between builders and users have been at the meetings of technical societies, principally those of the American Society of Mechanical Engineers and the Society of Automotive Engineers. It is not proposed to supplant the activities of the machine shop practice and production divisions of these societies; but rather to cooperate with and extend the commendable work that has been done by them. Cooperation should result in bringing about a closer contact between builders and users of machine tools, and a better understanding of the problems that confront them all.

* * *

FLYWHEELS FOR MILLING MACHINES

A production executive recently mentioned that a flywheel is a valuable feature for machine tools where the cut is not steady, but intermittent, as in milling machines and gear-cutting machines. The use of a flywheel reduces chatter, lengthens the life of the milling cutter or hob, and makes it practicable to increase the speed of the machine.

The use of a flywheel has been especially recommended for production work. "If you have a large, heavy spindle," said the executive quoted, "with considerable torsional rigidity, mounted on roller bearings and provided with a flywheel, you can plow through forgings with intermittent cuts without difficulty. A milling machine should not be tested on a cut where there is a steady pull. The real test comes when the cut is intermittent, but then a flywheel is required."

In his own plant this shop executive has applied 24-inch flywheels to eighty machines, and says that this installation has had a marked effect on the results from these machines.

National Machine Tool Builders' Meeting

THE twenty-sixth annual convention of the National Machine Tool Builders' Association was held at the Hotel Aspinwall, Lenox, Mass., October 10 to 13. An unusually large number of members were present and earnest consideration was given to the different problems confronting the machine tool industry. The discussions at the meeting covered a great many subjects of importance to the field of the association.

The president of the association, James E. Gleason, president of the Gleason Works, Rochester, N. Y., in his opening address, an abstract of which will be found on page 189 of this number of MACHINERY, referred to the problems of the industry that demand attention and action at present.

Association Held First Convention Exactly Twenty-five Years Ago

The general manager of the association, Ernest F. DuBrul, in his report pointed out that the present meeting marked another significant milestone in the history of the association. Twenty-five years ago, during exactly the same week of October, was held the first convention of the association as now constituted. On October 14 and 15, 1902, the largest meeting of machine tool builders ever held up to that time convened with thirty manufacturers present. At that meeting the present name of the association was adopted and the first officers elected. The National Machine Tool Builders' Association, therefore, is one of the oldest trade associations in American industry. Today, it has 130 member companies.

P. E. Bliss, Newly Elected President of the National Machine Tool Builders' Association

Mr. DuBrul referred to the success of the association's first machine tool exposition, a more complete report relating to which was later given by J. Wallace Carrel, chairman of the exposition committee. Mr. DuBrul also referred to the Machine Tool Congress, another progressive movement started in connection with the Cleveland exposition, which held its first meeting during the exposition week. This organization promises to develop into a valuable forum for the interchange of thought on all questions of mutual interest to users and builders of machine tools.

During the year important work has been carried on by various groups organized within the association. The standardization committee has begun its studies of immediate standardization activities, and the committee on cost accounting has done some valuable work. During the past year a standard spindle-end and arbor for milling machines was adopted by the milling machine manufacturers; this is a remarkable example of cooperation between the manufacturers of one line of machine tools.

Investigation Shows Financial Returns of Industry to be Very Small

Mr. DuBrul spoke at length on the methods used for charging depreciation in the machine tool building industry, pointing out that widely divergent practices are followed, and in many cases altogether insufficient amounts are charged to the depreciation account. A report was also made of a study of sales and profits in the industry during the last eight years. This study shows that the returns on the capital invested in the machine tool industry, as a whole, are exceedingly small; smaller, in fact, than would be the returns if the same capital were invested in the most gilt-edged low-yield bonds.

As a result of the information obtained from this study of the operation of the machine tool industry during the last eight years, the association adopted the following resolution:

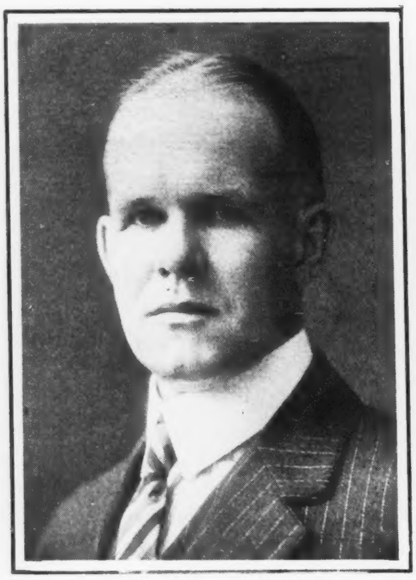
"Resolved, that in view of the results of the study of sales and profits in the machine tool industry, it is the opinion of the National Machine Tool Builders' Association that the level of profit of the industry, as a whole, is insufficient to permit the industry to give to its customers the research and engineering service that the interests of these customers demand, and also insufficient to maintain the scale of wages and salaries necessary to retain the high grade of personnel required in the industry."

Election of Officers and Directors

At the meeting the following officers were elected for the ensuing year: P. E. Bliss, Warner & Swasey Co., Cleveland, Ohio, president; Henry K. Spencer, Blanchard Machine Co., Cambridge, Mass., first vice-president; Henry Buker, Brown & Sharpe Mfg. Co., Providence, R. I., second vice-president; and E. A. Muller, King Machine Tool Co., Cincinnati, Ohio, treasurer. The following new directors of the association were elected: J. E. Andress, Barnes Drill Co., Rockford, Ill.; H. W. Dunbar, Norton Co., Worcester, Mass.; and H. E. D. Gray, Landis Tool Co., Waynesboro, Pa.

The Cleveland Machine Tool Exposition

J. Wallace Carrel, vice-president and general manager of the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, as chairman of the exposition committee, made a report on the results of the



H. K. Spencer, First Vice-president

Henry Buker, Second Vice-president

E. A. Muller, Treasurer

Cleveland Machine Tool Exposition. The total attendance was over 12,000, not counting the attendance one evening when the exposition was thrown open to the general public. The exposition brought vividly before the users of machine tools the importance of the industry. There were 428 machines in operation, ranging in size from a milling machine weighing 100,000 pounds, down to a small portable machine like an electric drill.

Many of the machines were entirely new, and were shown there for the first time; it is estimated that these numbered over one hundred. Many others embodied new features recently developed. To enable the machines to be shown in actual operation, more power was required than was available in the exposition hall, and a special transformer station was erected rated at 5000 horsepower; 3900 horsepower was actually connected up to motors driving machines on exhibition. The total number of exhibitors was 184, of which the machine tool exhibitors numbered 133. The total area covered by exhibits was 63,580 square feet, of which 82 per cent, or 51,980 square feet was devoted to the exhibition of machine tools.

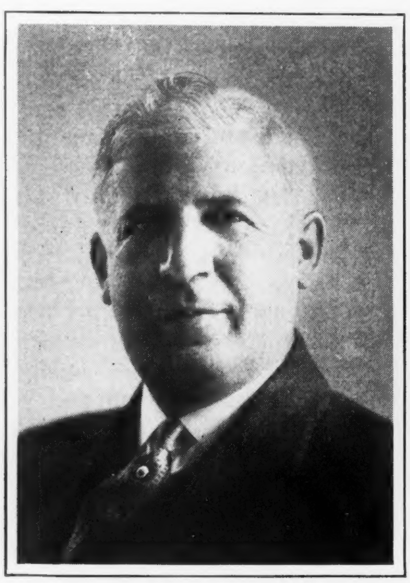
The association decided not to hold another exposition during 1928. A committee was appointed to report to the association, at an early date, recommending a definite time for the next exposition. Meanwhile, the members of the association are not planning to show machine tools at any other exposition or show during the coming year.

Papers Presented before the Convention

A very instructive paper entitled "The Machine Tool Industry Needs Constructive Cooperation, not Destructive Competition" was read by Colonel L. S. Horner, president of the Niles-Bement-Pond Co., New York City. In this paper, Colonel Horner outlined what has been done by manufacturers in other fields to secure cooperation, and advocated that similar steps be taken by the machine tool builders.

E. A. Muller, president of the King Machine Tool Co., Cincinnati, Ohio, spoke on the subject "Better Castings for Machine Tools." Mr. Muller emphasized the need for a study of the requirements of good castings and pointed out the methods by which better castings may be secured.

J. E. Andress, Newly Elected Director



H. E. D. Gray, Newly Elected Director

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H. W. Dunbar, Newly Elected Director

Problems of the Machine Tool Industry

Abstract of an Address by JAMES E. GLEASON, President, Gleason Works, Rochester, N. Y., Past President of the National Machine Tool Builders' Association

James E. Gleason, President of the National Machine Tool Builders' Association for the Past Year

AS an association and as individuals, we have reason to congratulate ourselves on the success of the Machine Tool Exposition at Cleveland. The hopes expressed by many that it would mark an epoch in the development of machine tools have been realized to a remarkable degree. I believe that I am correct in saying that not since the Centennial Exposition in Philadelphia, over fifty years ago, has such a demonstration been made of progress in our industry as was made at this exposition. Never has excellence in materials and beauty in design been so skillfully combined with outstanding efficiency. The interest shown by the friends and customers of the industry not only in this country, but also abroad, passed all expectations. Many machines were sold directly from the floor of the exposition, and a great many inquiries were received that will undoubtedly result in orders.

Low Prices and Shrinking Profits

At our last convention there was a great deal of discussion in regard to the matter of low prices and shrinking profits. So far as I can see, there has been no change in that respect during the last six months. Business generally appears to have been a little less than it was last year, and as we look ahead toward the close of this year and toward the beginning of next year, it seems reasonably certain that our final reports for the year 1927 will show that, as an industry, we have sold somewhat less this year than last year, and that what profit we got last year has been further reduced. And yet, in my judgment, the year that has passed may be considered a good average year for our industry.

The bad circumstances that surround selling prices and profits are not confined to our own industry. We hear the same cry from the steel makers, from the pig iron producers, and from other basic industries, almost without exception—that some of the product sold is sold at either no profit, or at a loss, that the capacity for production is still far ahead of the demand. Desperate attempts are made by cutting prices to secure for individual concerns more than their proportionate share of the orders available.

In the steel industry, under the splendid leadership of Judge Gary, much was done to correct this situation. He was not afraid to publish what he considered a fair price and to stick to it, and during his regime the customers of the United States Steel Corporation became convinced they could rely on this one-price policy, whether their orders were large or small.

And right here let me say that I think we should bear in mind that a one-price policy does not necessarily mean that a firm sells only at one price, regardless of quantity. Those of us who believe that, all things considered, the fairest way to sell our product is at one figure without any quantity discount, must recognize that, in the case of other concerns making a different product, a discount for quantity may be given without injustice to any one concerned.

It is very different, however, to modify a price to suit the sales resistance of any particular customer. This results only in a loss of his confidence in the stability and business integrity of the seller. One works manager recently said he knew of cases where the price quoted the superintendent of his concern had been lowered 20 per cent before the order was placed by his purchasing agent. Such an action could only bring discredit on our whole industry.

The Problem of Engineering Service

One of the most striking characteristics of the Show was the large number of special machines exhibited. This specialization of machines to fill the imperative demand which has arisen for them has compelled the manufacturer to greatly expand his designing and production staffs. We see a tendency to concentrate in one establishment complete engineering and production knowledge of various types of machines, such as turning, drilling, grinding, etc.

With the development of this special machinery has come a vastly increased demand on the part of our customers for engineering service. Sometimes a machine has been entirely redesigned to fit the needs of a single large producer. In such cases, the advantages of the machine have to be fully demonstrated to the supervisory organization, and more or less extended instruction given to the machine operators; and if a problem arises at any time in regard to the work, the machine builder is called upon to send a man from the factory to help solve it, even to the extent of investigating shop methods and processes entirely beyond the functions of the machine itself.

How Far Should Engineering Service be Rendered Free of Charge?

So long as this engineering service does not pass reasonable bounds, it may be given free of charge. If a concern spent a large sum of money on special "broadsides" or erected signs boosting its product, who would be willing to say that it was acting

against the general good, or contrary to sound business policy? Free engineering service is directly analogous. It is given to advertise the seller—to create good will—to make closer contact with the user and so retain his business. The management of each individual concern must determine for itself how much money it will spend in such free engineering service, just as it has to decide what amount it will spend in any form of advertising.

But owing to the startling increase in special machines of which I have spoken, customers have come to expect help on very special problems. It is difficult even for the best service men in our customers' shops to know everything there is to know about the complex machines now in use. They have come to rely, for recommendations that will best fit their special requirements, on engineers and production specialists from the machine tool builder's staff—men who have made a comparative study of the uses of their machine in its relation to a wide variety of methods and processes in different plants.

Our customers realize that, because of our opportunity for special study, we must know more about all the little peculiarities of our machines than men in their own organizations can, and so are equipped not only to give the best advice in regard to what jigs and fixtures are necessary, but actually to design them more efficiently and economically. The machine tool builder cannot ignore and should not want to avoid these requests for engineering assistance. He should welcome them and build up an organization that will adequately satisfy this call from his customers. He cannot, however, disregard the cost. It would be unfair to load on his customers generally the burden that would belong to a limited number. I believe the time is soon approaching—if it is not already here—when every firm will have to make a special charge for all service that involves the solving of the particular problems of which I have spoken, which are outside of the general operation, care, and maintenance of the machine sold.

* * *

POWER TRANSMISSION ASSOCIATION'S MEETING

The Power Transmission Association, with headquarters at 644 Drexel Building, Philadelphia, Pa., will hold its annual meeting at the Hotel Commodore, New York, Wednesday, December 7, at 10 A. M. At 1 P. M. there will be a joint luncheon with members of the American Society of Mechanical Engineers. Members of the latter society are invited to participate both in the general sessions of the association and in the luncheon. Possibilities of joint activities with the American Society of Mechanical Engineers will be discussed at the luncheon meeting by W. Batt, president of the S K F Industries and R. T. Kent, chairman of the Standing Committee on Professional Divisions of the A. S. M. E. An address on "Mechanical Power Transmission Economies" will be given by William Staniar, belting and transmission engineer of E. I. du Pont de Nemours & Co. The association, which was formed quite recently, numbers among its members the leading manufacturers of power transmission equipment.

SAFETY SUGGESTIONS FOR THE SHOP

By W. S. BROWN

Although primarily intended for a plant engaged in the building of engines, the following safety suggestions, compiled by the writer in connection with a recent safety campaign, are applicable to almost any manufacturing plant.

In piling up large castings such as machine bases and frames, the projecting of long spacing timbers into gangways should be avoided by placing the timbers diagonally across the castings.

Vertical racks at each machine for storing drills, reamers, etc., will help speed up production, keep the tools in order, and prevent overhanging ends from catching the clothing, as often happens when the tools are laid flat on the machine or bench.

The provision of portable tool trays for erectors discourages the practice of leaving tools near the edge of platforms, where they are often knocked off, with the result that someone on the floor below is injured.

Round shafts laid on the floor or on benches should have chocks to prevent rolling.

If nails are used in trestles to keep shafts from rolling, they should be removed when no longer required, in order to prevent clothing and flesh from being torn.

Paint "white and black zebra stripes" on planer tables and shaper rams that run out into gangways or aisles.

Paint the unused foundation bolts on erecting floors white or slip white cardboard collars over them.

Paint the edges on loading platforms and the side edges of steps white.

Always fasten the sling chain on the crane hook when it is to be transported to the work, as chains just "hung on," often slip off, and a workman might be under the chain the next time this happens.

Provide a round cap for the square ends of rotating shafts or spindles made to receive adjusting handles such as are used for changing the stroke of a shaper.

Place a guard around the vertical boring mill table to prevent projecting chuck jaws, etc., from injuring the workmen.

Provide guards for the ends of belt cones.

In the case of turret lathes having long tools that project beyond the machine frame, it is a good plan to pile the work on the floor beneath the projecting tools so that it will prevent anyone from coming in contact with the tools.

* * *

SPECIFICATIONS FOR DRAWING PAPER

The Federal Specifications Board of the United States Government, Washington, D. C., has issued a set of proposed specifications for detail drawing paper and T-squares. Those interested in these specifications may obtain copies by addressing the Federal Specifications Board, care of the Bureau of Standards, Washington, D. C. The board wishes to obtain comments or suggestions as to changes in these specifications, which may be deemed desirable by those interested. Such comments should be received by the latter part of November.

American Gear Manufacturers' Meeting

THE semi-annual meeting of the American Gear Manufacturers' Association was held at the Mount Royal Hotel, Montreal, Canada, October 20, 21, and 22. The meeting was, as usual, characterized by a very complete program. Thorough attention was given to the association's standardization work, and more than a dozen of the committees of the association made progress reports, final action to be taken at the spring meeting.

In opening the meeting, the association's president, E. J. Frost, president of the Frost Gear & Forge Co., Jackson, Mich., spoke on "Our Responsibility." He pointed out the value of trade associations, quoting a New York banker who recently said: "The time is coming when a bank's committee will ask the applicant for a loan if he is a member of his trade association—in other words, whether he is going it alone, trying to meet this intensive age without the help of his partners in industry." Mr. Frost quoted this because he felt that many trade association members are expecting far more from their association than they are putting into it—in work or attendance—and consequently are asking more than they have a right to take out.

E. J. FROST, President,
American Gear Manufacturers' Association

"We soon become accustomed to the conveniences of life," said Mr. Frost, "and are apt to forget the wearying research, the unremitting toil, and even the buffeting scorn and ridicule that are meted out to those untimid souls that have the hardihood to pioneer toward better things. We, in this fast age, grow peeved when we have to spend an extra second or two, in the dark, groping for the pendant switch that will turn on a flood of light, forgetful that it is well within the memory of most of us when we had to grope, not only for the kerosene lamp, but for the match box as well.

"What I am driving at, is this: The world has made wonderful progress, but it was not the achievement of a moment, and it came not without toil and sacrifice, perhaps not without suffering. All worthwhile things cost effort, and it is for us as an industry organization to be willing to pay the price necessary to the accomplishment of the things that we, as an association, have set out to do. These are: (1) The discussion of subjects of interest and value to the industry in which its members are engaged. (2) The advancement and improvement of that industry. (3) The collection and dissemination of statistics and information of value to its members. (4) The standardization of gear design, manufacture, and application. (5) The promotion of a spirit of cooperation among the members for the improved production and increased application of gears.

In referring specifically to the work to be done immediately, Mr. Frost pointed to the need for the standardization of hobs, more knowledge on the subject of steels suitable for gears, and on cutting tools, especially those used for gear-cutting. He urged discussion of the question of fire protection and adequate fire insurance to meet present-day values of buildings and equipment.

"We should," said Mr. Frost, "carry on the work done at the Massachusetts Institute of Technology in reference to tooth wear and deflection under load, and get the results of these experiments reduced to practical form, so that they can be used by all of our shops in our quest for better gears. In another direction, we should, through our contacts at the meetings, attempt to bring about more intelligent and uniform methods of cost finding.

"Through our library committee we are doing a very constructive piece of work in the collection and dissemination of statistics and information. Our commercial standardization has also been of service in the past, and can continue to be so by the sending out periodically to the membership of information regarding the trend of business in general and in specific lines. We next come to what, in some ways, has proved to be our big endeavor—the standardization of gear design, manufacture, and application.

"In closing, let me say that the gear business doubtless will continue to call for as great exertion of brain and brawn as it now does, if not greater, and woe betide that plant that does not continually keep setting its house in order by keeping pace with the times in man-power, machinery, methods, and management; the four M's of industry."

Marine Gear Drives

In a paper entitled "Marine Gear Drives," by A. A. Ross of the General Electric Co., a review was given of the development of these drives and of the experience of the General Electric Co. in the application of gear drives to ship propulsion. In this connection, Mr. Ross stated that the records of each successful gear application, be it in the automotive, industrial, or railway field, has in its

early history been filled with discouraging failures, but on the final page, successful applications have always been recorded, and the success has been due to the fact that careful observations have been made of actual service conditions.

The application of gears to the propulsion of merchant ships has been no exception to the rule. "The records," said Mr. Ross, "show failures so serious that many marine engineers recommended the substitution of combustion engine drive and turbine electric drive, while others turned back to reciprocating steam engines; but actual service observation has resulted in reliable and efficient types of gears for both merchant and naval ships. Cruisers and destroyers built in recent years, as well as those under construction and those planned, are turbine gear driven. This speaks well for the efficiency and reliability of gears for that class of naval ships. It is also now quite generally recognized that double reduction gears are the most suitable intermediate between the turbine and propeller for 10- to 12-knot cargo boats and tankers of approximately 8000 to 10,000 deadweight tons, requiring 2500 to 4000 shaft horsepower. The reduction is from 2400 or more revolutions per minute of turbine to 90 revolutions per minute at the propeller."

Methods of Standardization

An instructive paper was read by Clifford B. LePage, assistant secretary in charge of standardization work of the American Society of Mechanical Engineers. This paper was entitled "Some Observations on the Making of American Standards," and outlined first, the reasons for and advantages of national standardization, as compared with standardization work carried on by separate groups and trade associations without broad coordination of all other interests; and second, the principal steps in the development of a standard under the procedure of the American Engineering Standards Committee. Mr. LePage particularly pointed out the advantage of national standardization methods in that they give the consumer an opportunity to have a voice in the establishment of standards for products that he intends to purchase. There is a growing sentiment among purchasers favorable to the use of purchase specifications of some kind. In buying and selling, there are two interested parties, and standard specifications are of advantage to both. The users' interest in such standards centers around (a) interchangeability of component parts; (b) prompt filling of orders from the stocks of the manufacturer; (c) ready replacement of damaged and worn parts; (d) avoidance of misunderstanding by a uniform nomenclature; and (e) not infrequently a reduction in the selling price. In a word, he has interests that are similar in some respects to those of the manufacturer, but that are enough different to justify his having a place in the standardization program. Manufacturers of gears and gear drives, for example, are at the same time purchasers of tools and materials, and recognize the importance of standard specifications for cast iron, steel, and bronzes intended for their use, and the American Gear Manufacturers' Association has, in fact, set up standard specifications for these materials.

Another reason for national standardization work is that there is inspiration, enthusiasm, and economy in group action. The A. E. S. C. (American Engineering Standards Committee) procedure calls for the organization of sectional committees which are broadly representative of the social and economic interests of producer, consumer, and general public. This provision fits in with the principle previously stated, that the making of standards is a vital process to all. Consequently, it is most successful, in the long run, when carried on in a way that fits in readily with our complete social and economic life.

Papers on Worm-gears and Gear Hobs

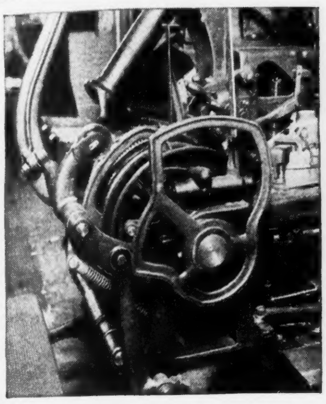
George H. Acker, chief engineer of the Cleveland Worm & Gear Co., Cleveland, Ohio, outlined in some detail the methods used for the inspection of worm-gears and their testing. It was stated that the general trend of the last few years toward higher operating speeds and more compact mechanisms have caused a continual process of development in the manufacture of worm-gearing. The increased operating speeds and improved gear materials have called for greater accuracy of manufacture than formerly. To meet these new conditions, improved testing methods have been developed. The requirements for different applications of worm-gears may call for slightly different methods of testing, but Mr. Acker's discussion was limited to the automotive type of gearing or to gearing produced on a quantity basis.

Inspection must take account of the following factors: Eccentricity of the worm; size of the worm; "index" of multiple-thread worms; lead of the worm thread; profile of the worm thread; angle of the gear; eccentricity of the gear; and silence of operation.

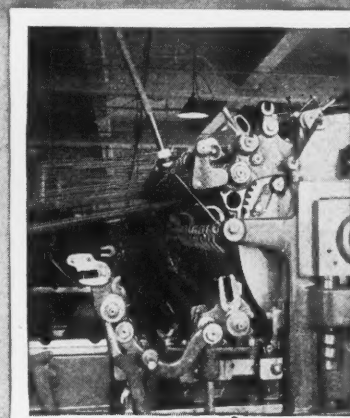
James A. Hall, professor of mechanical engineering at Brown University, and consulting engineer with the Brown & Sharpe Mfg. Co., presented a paper entitled "The Effect of Hob Corrections on Gear Teeth." He pointed out that with the increasing use of tip relief on gear teeth it is necessary to decide not only upon the extent to which the tooth curve should be modified, but also what form of hob or other cutting tool is required to generate the desired shape.

In connection with the work of the tooth form committee of the American Gear Manufacturers' Association, normal sections of modified 14 1/2-degree hob teeth as produced by hobs made by five different concerns were made. These sections indicated that the different hob manufacturers hold widely varying ideas as to the proper solution of the problem presented. The paper comprised a thorough investigation of the problem and was accompanied by diagrams, drawings, and mathematical formulas, indicating that a very conscientious study had been made of the subject.

The following companies were elected to membership in the association: Fairfield Mfg. Co., Lafayette, Ind., with A. J. McAllister as executive representative; Perkins Machine & Gear Co., Springfield, Mass., with J. L. Perkins as executive representative; and Goodman Mfg. Co., Chicago, Ill., with W. T. McCullough as executive representative.



Ingenious Mechanical Movements



DISENGAGEMENT OF WORM-GEARING FOR RAPID ADJUSTMENT

By WALTER S. BROWN

A hand-operated winding drum used for adjusting the height of airplane models in a "wind tunnel" is so arranged that the drum may be rotated either through worm-gearing for precise adjustments, or directly, by disengaging the worm-gear, when rapid adjustments are desired. The airplane model is supported by wires *A* which pass up over pulleys and then to the winding drum *B*. The rotation of this drum winds or unwinds both wires simultaneously. The knurled handwheel *C* is used for fine adjustments, motion being transmitted through a single V-thread worm *E* and a straight-faced worm-wheel *D* located at one end of the drum. If a rapid adjustment is required, the worm-wheel is disengaged from the worm merely by pulling the worm-wheel and drum axially on bolt *F*; the drum is then turned directly by hand, the flange *G* being knurled to provide a better grip.

When the outward pull is released, spring *H* immediately forces the worm-wheel back into mesh, thus relocking the setting. The handwheel *C* is graduated on top so that the amount of adjustment can be determined. Although this device is fitted to laboratory apparatus, the idea of sliding a worm-wheel axially out of mesh with the worm might be utilized for other purposes; however, it is evident that only straight-faced worm-wheels could be used. For some applications, it might be preferable to replace the knurled portion of the winding drum with a spur gear arranged to slide into engagement with driving gears when the worm-wheel was disengaged. Another variation for possible application to small lifting blocks would include a friction brake for rapid lowering by gravity.

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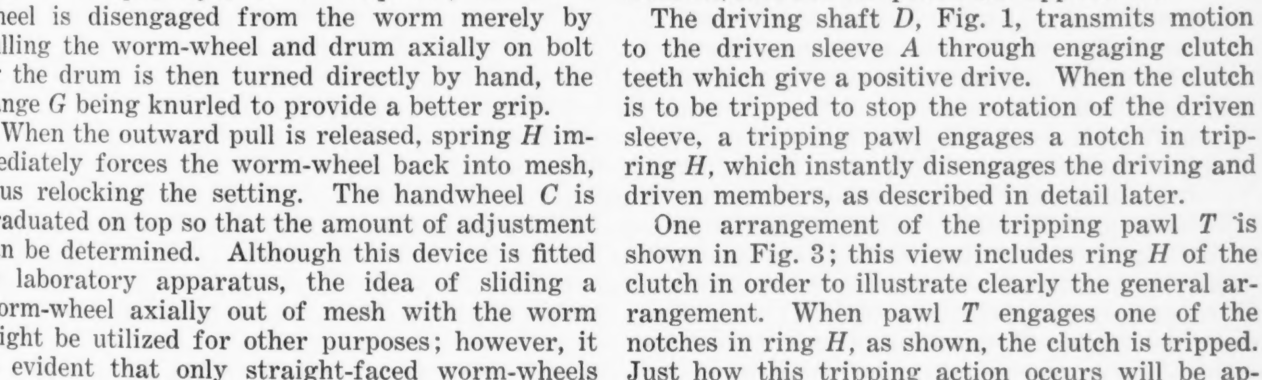
SENSITIVE TRIPPING CLUTCH FOR DELICATE MACHINERY

By A. W. JANSSON

A sensitive tripping clutch designed by the writer for use on delicate machines of various classes, and whenever quick disengagement is required, is so arranged that the tripping action can be controlled automatically by whatever method is most suitable for the particular application.

The driving shaft *D*, Fig. 1, transmits motion to the driven sleeve *A* through engaging clutch teeth which give a positive drive. When the clutch is to be tripped to stop the rotation of the driven sleeve, a tripping pawl engages a notch in trip-ring *H*, which instantly disengages the driving and driven members, as described in detail later.

One arrangement of the tripping pawl *T* is shown in Fig. 3; this view includes ring *H* of the clutch in order to illustrate clearly the general arrangement. When pawl *T* engages one of the notches in ring *H*, as shown, the clutch is tripped. Just how this tripping action occurs will be apparent by referring to the details of Fig. 1. The driving shaft is connected to sleeve *E* by pin *F*,



Worm-gearing Arranged for Quick Disengagement when Rapid Adjustment is Required

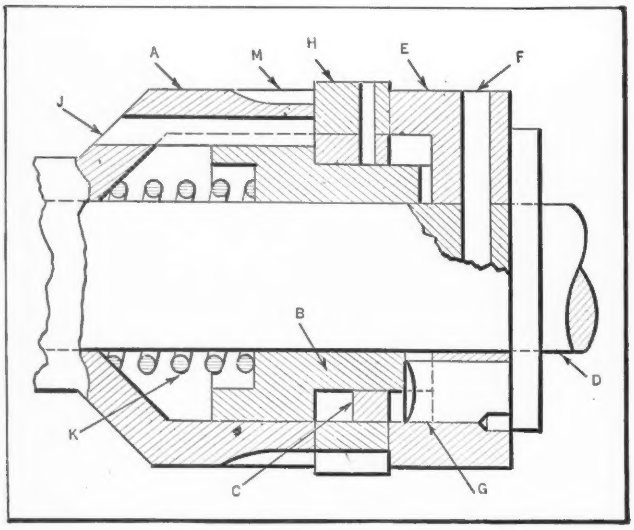


Fig. 1. Sectional View of Sensitive Tripping Clutch

and in sleeve *E* there are four driving pins *G*. These pins engage teeth on the small diameter of throw-out cam *B*. The cam (which is shown in detail at *B*, Fig. 2) is secured to the driven sleeve *A* by four pins *J*, Fig. 1, in such a manner as to allow cam *B* to slide axially. When in the running position, cam *B* is held in engagement with driving pins *G* by spring *K*.

Trip-ring *H* and ring *C* are connected by pins, so that they function as a single part, which can revolve but cannot move in any other direction. Clutch teeth on ring *C* are in alignment with corresponding teeth on the larger part of cam *B* (see detail of ring *C* in Fig. 2). When the tripping pawl, which normally is out of engagement with ring *H*, snaps into the tripping position, rings *H* and *C* stop revolving. Throw-out cam *B*, however, and the driven sleeve continue to revolve until the teeth engaging ring *C* slide backward far enough to disengage the teeth engaging driving pins *G*, thus stopping the rotation of *B* and the driven sleeve. It will be seen, therefore, that the teeth on ring *C* act as cams to disengage the teeth on the

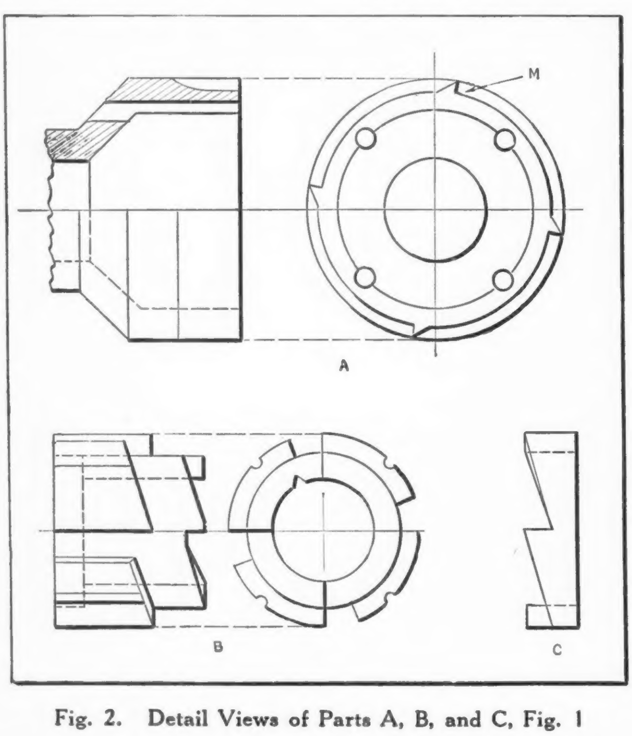


Fig. 2. Detail Views of Parts A, B, and C, Fig. 1

smaller diameter of *B* which mesh with the driving pins.

To prevent continued rotation of the driven sleeve, as the result of friction, small teeth *M* are provided in the driven sleeve (see also detail view *A*, Fig. 2). These teeth *M* are also engaged by the tripping pawl, but they are so spaced in assembly that there is time enough after the stopping of ring *H* for the driving and driven teeth to disengage before a tooth *M* on the driven sleeve comes around into engagement with the tripping pawl. The end of the driven sleeve can be fitted with either a gear or sprocket, according to the driving requirements.

The method of tripping the clutch depends upon how the clutch is applied. The diagram Fig. 3

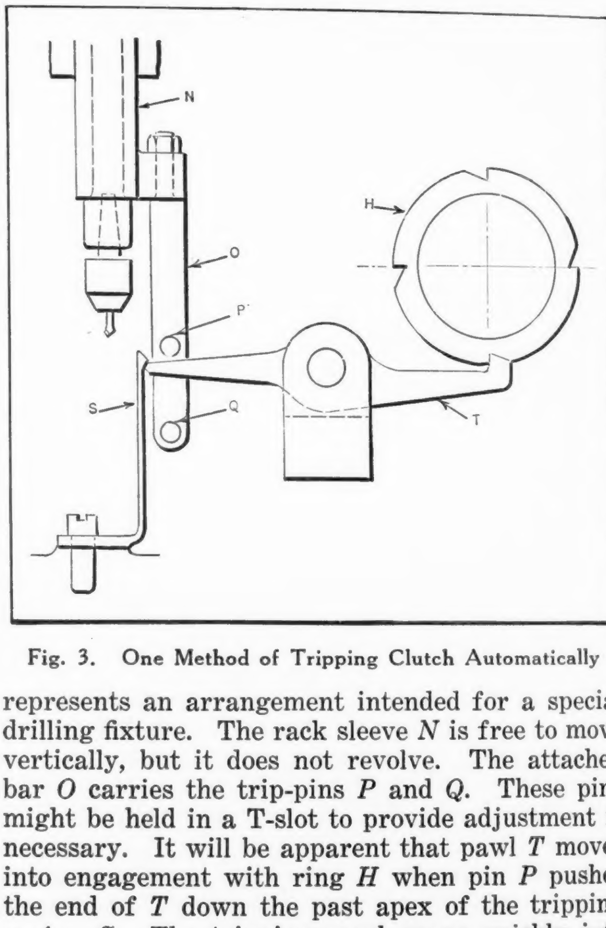


Fig. 3. One Method of Tripping Clutch Automatically

represents an arrangement intended for a special drilling fixture. The rack sleeve *N* is free to move vertically, but it does not revolve. The attached bar *O* carries the trip-pins *P* and *Q*. These pins might be held in a T-slot to provide adjustment if necessary. It will be apparent that pawl *T* moves into engagement with ring *H* when pin *P* pushes the end of *T* down the past apex of the tripping spring *S*. The tripping pawl snaps quickly into engagement with ring *H* after its pointed end passes the apex of the tripping spring. The disengagement of the tripping pawl and the engagement of the clutch occurs when pin *Q* strikes the pawl as it ascends. By varying the angle of the engaging points on pawl *T* and spring *S*, the sensitiveness of the tripping action may be varied as required. This general method of tripping can be applied when tapping to certain depths and for various similar purposes.

An entirely different tripping arrangement is illustrated by the diagram Fig. 4. This particular arrangement might be utilized in connection with fine wire drawing or whenever the tripping of the clutch is to occur automatically in case of wire or thread breakage. The diagram represents wire drawing, although it is evident that the same principle might be applied to other processes. The winding drum is indicated at *R*, the drawing die

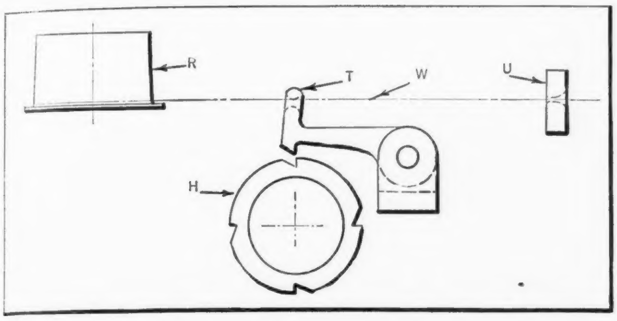


Fig. 4. Clutch-tripping Arrangement for Wire Drawing or Similar Process

at U, and the wire by line W. The wire passes through a bell-mouthed hole in tripping pawl T. The pawl, in this instance, is supported by the wire under normal working conditions. If the wire should break accidentally, or if the end passes through the die, the pawl drops by its own weight and engages the trip-ring H. It will be evident from the foregoing examples that the tripping of the clutch might be controlled in many other ways.

* * *

SCOTCH YOKE MODIFIED TO GIVE DWELL AT EACH END OF STROKE

By WILLIAM B. MEGLITZ

The well-known Scotch yoke or slotted cross-head converts a rotary crank motion into a harmonic reciprocating motion. With the modified design shown in Fig. 1, the driven cross-head or slide has a dwell at each end of the stroke equivalent to about 60 degrees of crank rotation.

This mechanism is part of a double flanging press used in the manufacture of certain cans. The flanging is done in three operations at the rate of eighty cans per minute, and as a slight amount of time is required for the cans to drop from one working position to another, the dwell obtained with this mechanism allows for this. The drive is from pinion A to gear B. The eccentric crank C has a bearing in gear B, and carries at one end (see plan view) a pinion D which meshes with a stationary gear E, the ratio of these two gears being 2 to 1.

As gear B revolves, the planetary pinion D rotates around fixed gear E; consequently, crankpin C turns about the axis F (see Fig. 2) of its bearing in gear B, while this axis follows a circular

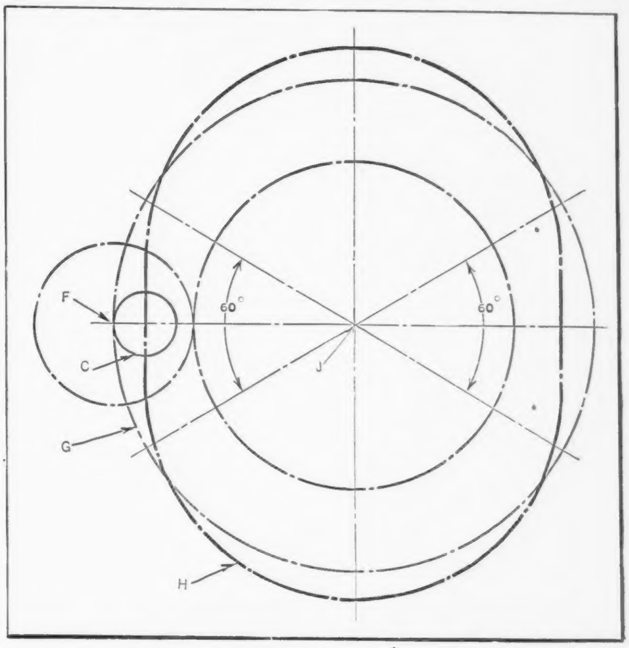


Fig. 2. Diagram Showing how Eccentric Rotation of Crankpin Causes Dwell at Ends of Stroke

path G. These combined rotary motions of C about F and of F around path G cause the axis of eccentric pin C to describe an oblong path, as indicated by line H. The straight sides of this oblong path represent the dwelling periods at each end of the stroke. This approximately straight-line movement of the center of pin C during nearly 60 degrees of crank rotation on each side is due to the fact that the center of crankpin C moves inward toward center J, so as to offset, during this period, the circular movement. The driven slide or cross-head is supported on pivoted guides K and L, Fig. 1. This mechanism doubtless can be applied to various classes of machinery requiring dwell at the ends of the stroke.

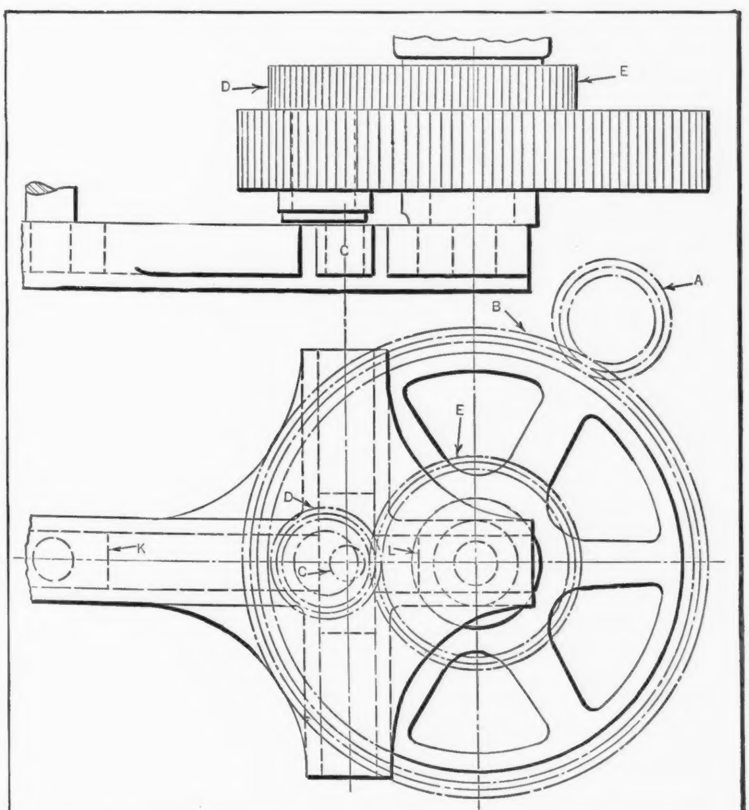
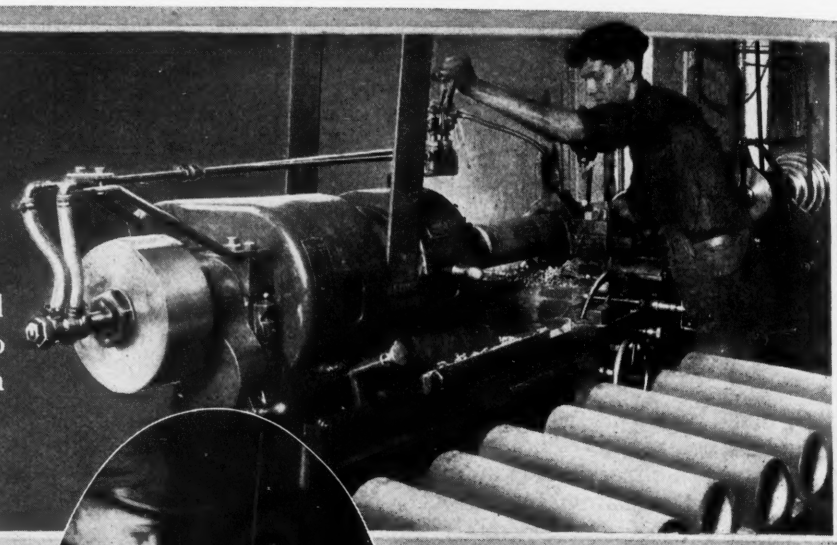


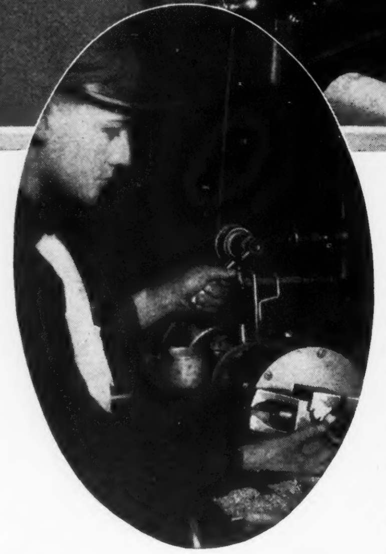
Fig. 1. Scotch Yoke Having an Eccentric Planetary Crankpin which Provides Dwell at Each End of Stroke

* * *

It may truthfully be said that the practice of mechanical engineering deals with two classes of raw materials, namely, metals and fuels; for while the former is essential for the construction of the machines which bulk so largely in the practice of mechanical engineering, these machines would in the main be useless without the fuel necessary to drive them.—*Dr. Cecil H. Lander*

Air Chucks and Fixtures





Pneumatically Operated Equipment Designed to Save Time and Labor in Quantity Production

AIR-OPERATED clamps of the construction illustrated in Fig. 1 were furnished by the Hannifin Mfg. Co., Chicago, Ill., for application to a fixture used for holding automobile transmission cases while boring. Each unit consists of two sets of cylinders and clamping mechanisms, the two cylinders being contained in one casting.

Air is admitted simultaneously into each cylinder of a unit for operating two pistons of the construction shown at *A*. As each piston is forced forward, the rod *B* carries two links *C* forward, which actuate two bellcrank clamps *D*. These clamps act against flanges on the transmission case, thus holding the case firmly against the walls of the fixture. The flanges gripped by clamps *D* are inside of a cored opening in the transmission case. When air is admitted into the cylinders to pull the pistons toward the left-hand end, as viewed in the illustration, links *C* and clamps *D* assume the positions indicated by the dotted lines *X* and *Z*, respectively.

Chucks with Pressure-equalizing Mechanisms

The lathe chuck shown in Fig. 2 is so designed that each of the three jaws grips the work with an equal pressure, thus compensating for irregularities in the contour of the surface gripped. The work is located accurately for the operation by slipping the previously reamed hole over mandrel *A*. Then when air is admitted into the cylinder to pull the piston and rod *C* toward the left, the work is gripped firmly on the mandrel by three serrated jaws *B*.

As rod *C* is moved toward the left, it carries with it compensating plate *D* and three sliding wedges *E*, the latter forcing the jaws on the work. Plate *D* is free to float a limited amount on rod *C* to suit variations in the diameter of the work which affect the forward or backward positions of wedges *E*, these wedges being always kept at a given distance from the center of the chuck and prevented from tilting. Pins *F* which connect the wedges to plate *D* have spherical heads. When air

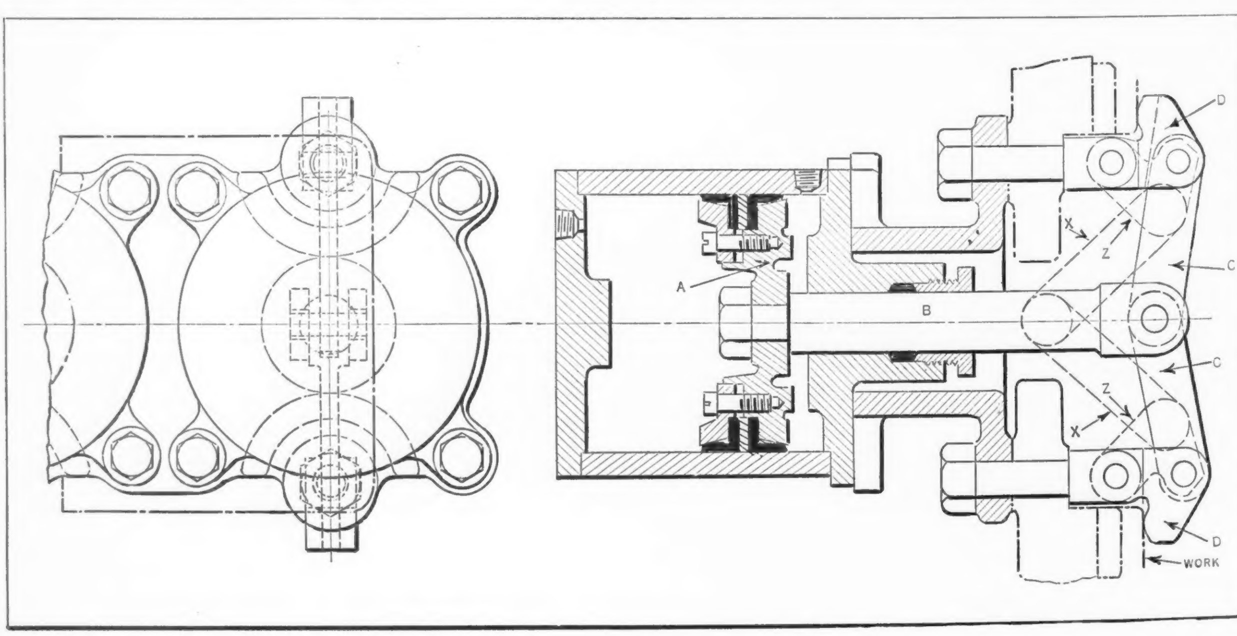


Fig. 1. Air-operated Clamping Unit, which may be Incorporated in Various Types of Work-holding Fixtures and Jigs

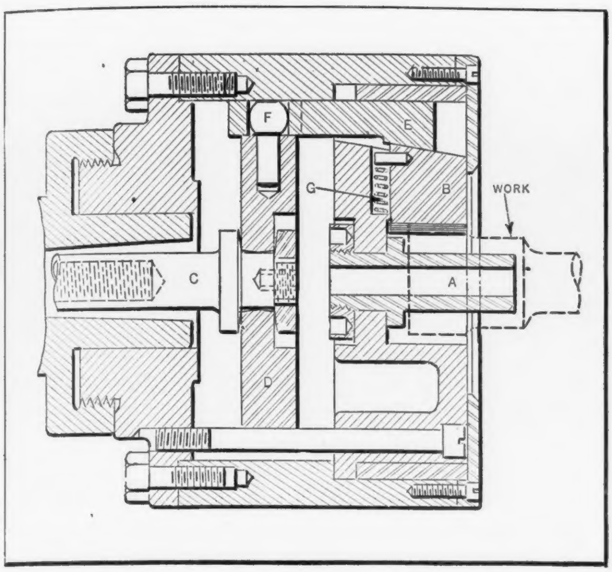


Fig. 2. Lathe Chuck Designed to Compensate for Variations in the Work

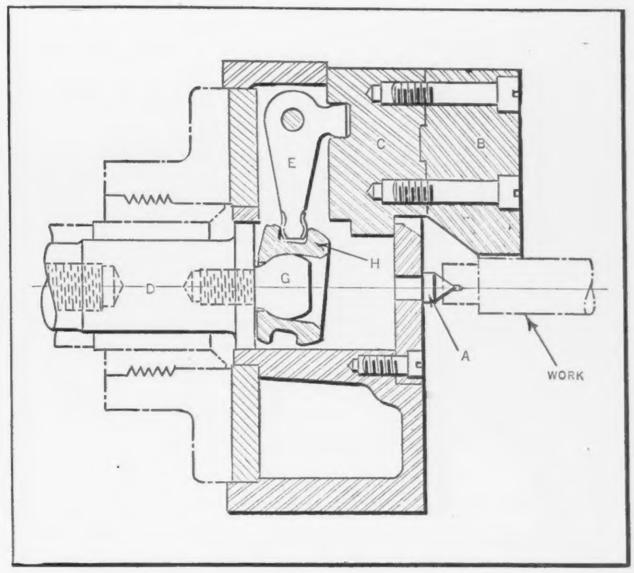


Fig. 3. Another Design of Chuck with Pressure-equalizing Mechanism

is admitted into the cylinder to release the chuck jaws, they are forced outward by the action of springs *G* against pins fastened to the jaws.

Another chuck that produces a uniform pressure on all points of the work in contact with the jaws, regardless of variations in the contour of the surface gripped, is illustrated in Fig. 3. This chuck is designed for holding a bar piece which is center-drilled before it comes to the machine. The piece is supported at the head end on center *A*, and gripped by three jaws *B*, which are fastened to blocks *C*. When air is admitted into the cylinder to grip the work, bar *D*, which is connected to the piston-rod, is drawn toward the left. This movement causes bellcrank levers *E* to pull blocks *C* and jaws *B* toward the work.

Ball-head stud *G* and socket *H* form an equalizing connection between rod *D* and the three bellcrank levers *E*. The ball head permits the socket to assume any position necessary to compensate for differences in the distance from the center of the chuck to jaws *B*. Hence, should the hole in the end of the work be drilled off center, the work will still be gripped firmly by each jaw. Driving of the work is accomplished, of course, through the jaws.

Expanding Mandrels for Long Housings

Units of the design shown at *X* and *Y* in Fig. 4 have been built for gripping the ends of pressed-steel housings during lathe operations. Unit *X* is mounted on the headstock of the lathe, and unit *Y* on the tailstock; hence, the latter unit can be moved along the bed to suit the length of the work. Housings up to 56 inches in length are machined with this equipment. Separate air cylinders and pistons are provided for each unit, but the units are operated together for gripping or releasing the housings.

It will be seen that each unit is provided with four pins *A* which are expanded radially against the inside of the housing when bars *B* are drawn back by their respective cylinder and piston equipment. When bars *B* are advanced, pins *A* are pulled toward the center of the mandrel through the action of four coil springs *C* which connect small bars held in slots in the ends of pins *A*. One pin *A* of each unit abuts against a surface of the work that is closer to the center of the mandrel than the surfaces in contact with the other three pins; hence, the work must always be placed on the mandrels in a given relation. The housings are located lengthwise by positioning them against shoulder *Z* on each mandrel.

Fixture for a Vertical Machine

Fig. 5 shows a fixture designed for holding a part vertically while turning, counterboring, and facing cuts are being taken, after the bore has been

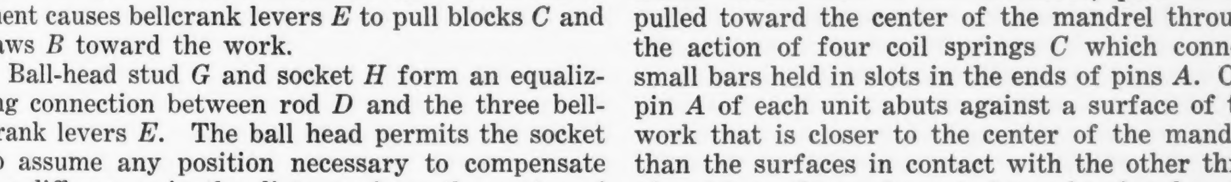


Fig. 4. Expanding Mandrels Used in Gripping Both Ends of Long Housings during a Lathe Operation

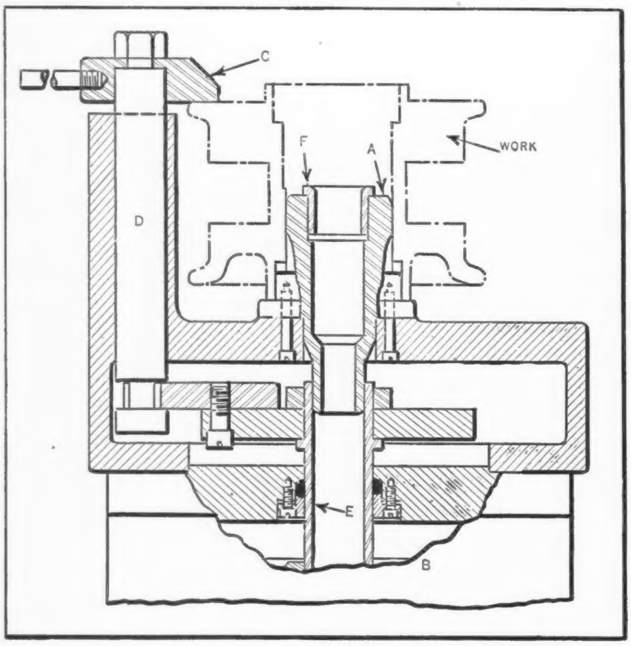


Fig. 5. Fixture Designed for Holding Work in a Vertical Position

machined. When one end of the part has been finished, the work is reversed in the fixture to permit finishing the opposite end. The finished bore of the part is seated over the hardened and ground plug *A*, and air is then admitted into cylinder *B*, thus pulling the piston downward and tightening three clamps *C* on the top face of the work. These clamps are mounted on the upper ends of rods *D*, which are connected by means of blocks and a circular plate to the hollow piston-rod *E*.

Clamps *C* may be conveniently swiveled on their posts when released, so as to facilitate reloading the work. The bar on which the tools for this operation are mounted has a pilot which enters bushing *F*. Both plug *A* and piston-rod *E* are hollow, permitting chips and cutting lubricant to escape.

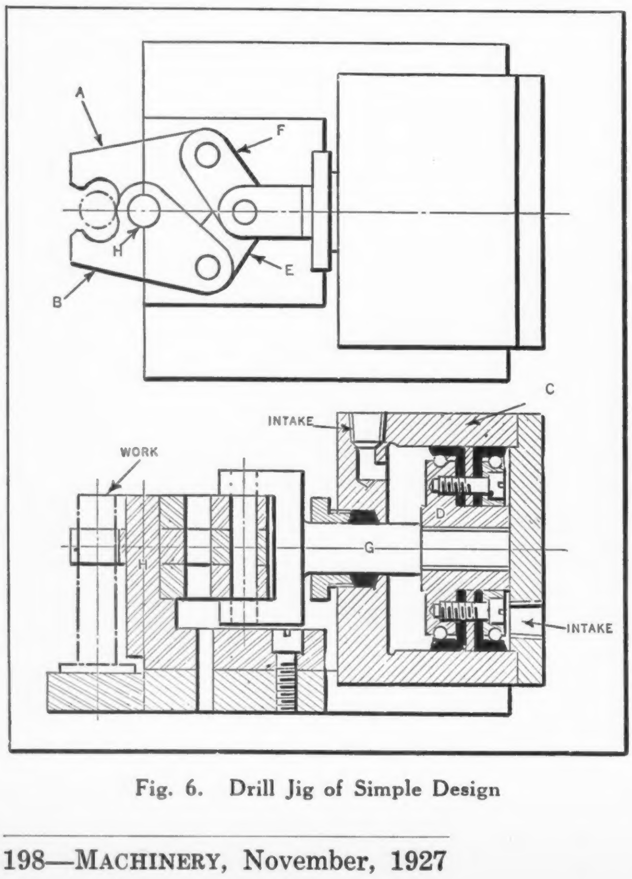


Fig. 6. Drill Jig of Simple Design

Simple Drill Jig

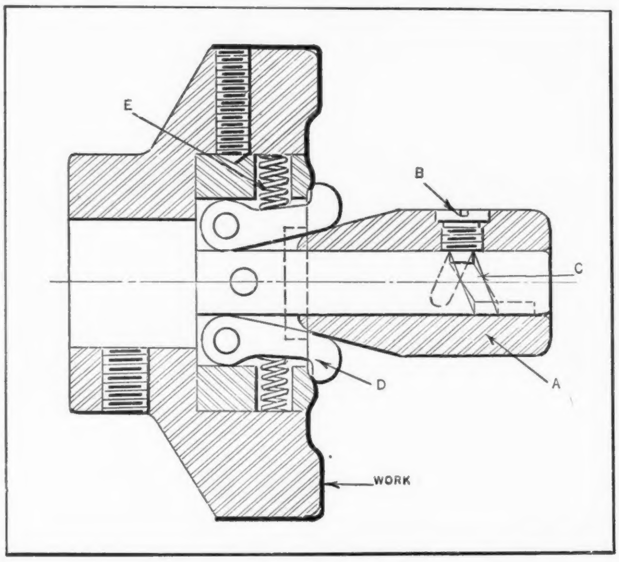
Bolts and similar parts may be conveniently held in a vertical position in the jig illustrated in Fig. 6, while being drilled on one end. When air is admitted into the rear end of cylinder *C*, piston *D* is forced forward, and the two links *E* and *F*, which are connected to piston-rod *G*, cause jaws *A* and *B* to swivel on post *H* and grip the work firmly. Post *H* is integral with a block fastened to the fixture base.

Previous articles in this series have been published in June, July, and August MACHINERY. Further examples of air-operated devices will be described in a subsequent article.

* * *

BUFFING CHUCKS WITH A BAYONET LOCK

Chucks of the design shown in the accompanying illustration are provided on a four-spindle type K machine built by the Automatic Buffing Machine Co., Buffalo, N. Y., for buffing sheet-metal stampings of the shape indicated by the heavy lines.



Buffing or Polishing Chuck with Bayonet Locking Arrangement

These stampings have an internal diameter of 3 5/8 inches. The mechanical feature of this type of chuck is a bayonet locking arrangement which holds the work securely for the operation.

Handle *A* is provided with a screw *B*, the inner reduced end of which engages a bayonet groove *C* on the spindle of the machine. The handle is merely given a half turn to advance it into the position shown or to withdraw it fully from that position. When the handle is advanced into the position illustrated, the tapered end swivels two fingers *D* radially against the work, and these fingers are held in that position until the handle is withdrawn. At that time, two springs *E* insure the return of the fingers so as to release the work.

* * *

There is a notion that capital has an inherent power of great production. The fact is that capital is naturally mortal. If left to itself, it suffers decay. It is only as a tool or instrument in the hands of competent management that it reveals the power of creating new wealth.—*Commerce and Finance*

The Effect of Seasoning on Cast Iron

By FORREST E. CARDULLO, Chief Engineer, G. A. Gray Co., Cincinnati, Ohio

WHEN a casting or, in fact, any piece of iron or steel containing carbon and other substances cools from a white heat, it passes through a number of states during the process of cooling. The particular chemical compounds and crystalline forms in the metal at any specific period depend on its temperature at that particular period. As the temperature falls, some of the chemical compounds tend to change to other forms, and the atoms tend to arrange themselves into a different crystalline structure. Since the iron is solid, there is a resistance to this change, and some time is required for the transformation.

If the rate of cooling is slow, there will be ample time for the iron to assume its natural or stable condition at each temperature. If, however, the rate of cooling is extremely rapid, the iron will retain the structure resulting from the higher temperature, after it has been cooled to a low temperature, and there will be a tendency for the iron to assume the chemical composition and structure appropriate to the lower temperature. The volume of the iron varies but slightly with the structure. Some structures have a slightly larger volume for the same number of atoms than other structures.

Effect of Slow Cooling

If a casting is allowed to cool slowly, it passes successively through the various changes necessary to bring it finally to a stable condition. The whole casting will have that structure which is stable at ordinary temperatures and there will be no tendency for the casting to change its structure after it has been removed from the mold. If, however, a casting is cooled rapidly, by taking it out of the sand as soon as the iron has set, certain parts of the casting, particularly the corners, edges, and thin surfaces, will have the form that is stable at a higher temperature and will tend to change their crystalline structure. Consequently, they will also change in volume at a very slow rate. In such cases, the casting will be found to be extremely hard on the surface.

The gradual change in structure accomplished by slight changes in volume will have very little effect on the casting if the whole casting is of the same structure. However, if, the thick parts have one structure, while the thin parts have another, or the surface of the material has one structure while the interior has another, slight changes in volume will be accompanied by a considerable change in form, due to warping.

Changes of this kind are not to be compared in magnitude with the effects produced by shrinkage strains. As a matter of fact, such changes are almost invariably accompanied by shrinkage strains, since those conditions and operations that produce these effects are similar to those that produce shrinkage strains. The principal difference between these effects and shrinkage strains is that unless shrinkage strains are relieved by machining, no change in the form of the part occurs. In the phenomena of structural changes, however, small and slow changes in the form of the part occur, even though the piece is not touched by a tool.

Changes in Crystalline Form

Changes in the crystalline form should not prove a serious matter in any type of casting. If such changes tend to produce unsatisfactory results, they should be guarded against by slowly cooling the casting in the mold, rather than by employing a long and expensive process of seasoning. If, because of the nature of the molding or for any other reason, it actually becomes necessary to season the casting, that is, to change its crystalline structure in certain parts, the desired result may be accomplished in a number of ways.

Changing Structure by Annealing

Annealing is the best and, in every respect, the most satisfactory method of changing the crystalline structure of a casting. This may be done at a temperature around 1400 degrees, allowing the casting to heat up and to cool down gradually. This insures a thorough job of seasoning which cannot be improved upon. In some cases, the casting can be satisfactorily seasoned by heating it once or twice in the core oven when baking cores, and allowing it to cool in the oven. It is not necessary, with the temperature employed, to take special precautions to insure gradual cooling but, of course, sudden cooling is not desirable.

Time Required for Seasoning

The usual method of seasoning a casting is to allow it to stand for a period of from two weeks to a year. There seems to be no data on the time required, but it is generally and correctly assumed that the longer the seasoning period, the better. The changes in structure go on at a gradually diminishing rate, following the usual law in such cases, which is, that if half the total change occurs within a certain period, say one month, then one-half the remaining change will occur during the second month and half of the remaining change during the third month, etc. Assuming that one-half the change occurs in one month, then if the piece were allowed to stand for six months, at the end of the sixth month only one-sixty-fourth of the total change would still remain to be completed.

Seasoning may be accelerated by setting the casting out in the sun. The rate at which the change takes place depends on the temperature of the casting. A casting that is left in the sun will season more rapidly than one that is protected from this source of heat. However, unless the casting is moved around occasionally, so that all parts are exposed to the sun, the seasoning may

be unsatisfactory, as a change in structure may occur in part of the casting, while another part is still subject to change.

Outdoor Seasoning

An advantage of setting a casting out of doors to season is that the surface of the casting rusts. Rusting not only removes the scale in which the changes are most acute, but it also promotes the rate of seasoning, because of the other chemical changes produced. Thus, rusting relieves to some extent the shrinkage strains and the tendency toward further changes in the structure, the same as removing a thin section of the surface by machining.

Many machinists are of the opinion that vibration relieves shrinkage strains and permits or brings about spontaneous changes in structure. Accordingly, small castings are frequently tumbled in order to season them, or they may be beaten by hammers or otherwise set into vibration. The theory back of this method is wrong, and the only result obtained by tumbling a casting is to peen the surface and thus introduce additional strains at the surface.

If a casting is properly handled in the foundry before it is taken out of the mold, seasoning is not necessary unless a part of the casting is chilled either intentionally or by a thin section coming in contact with damp sand. If seasoning is necessary, satisfactory results can usually be obtained by placing the casting in a core oven when baking a core. If the piece is one in which thorough seasoning is required, the casting should be annealed at a temperature of 1400 degrees.

Practically all the difficulties encountered in the shop which have been referred to are commonly believed to be caused by lack of seasoning, but are really due to an imperfect understanding of the methods that must be employed to counteract the effects of clamping, temperature variations, and shrinkage strains.

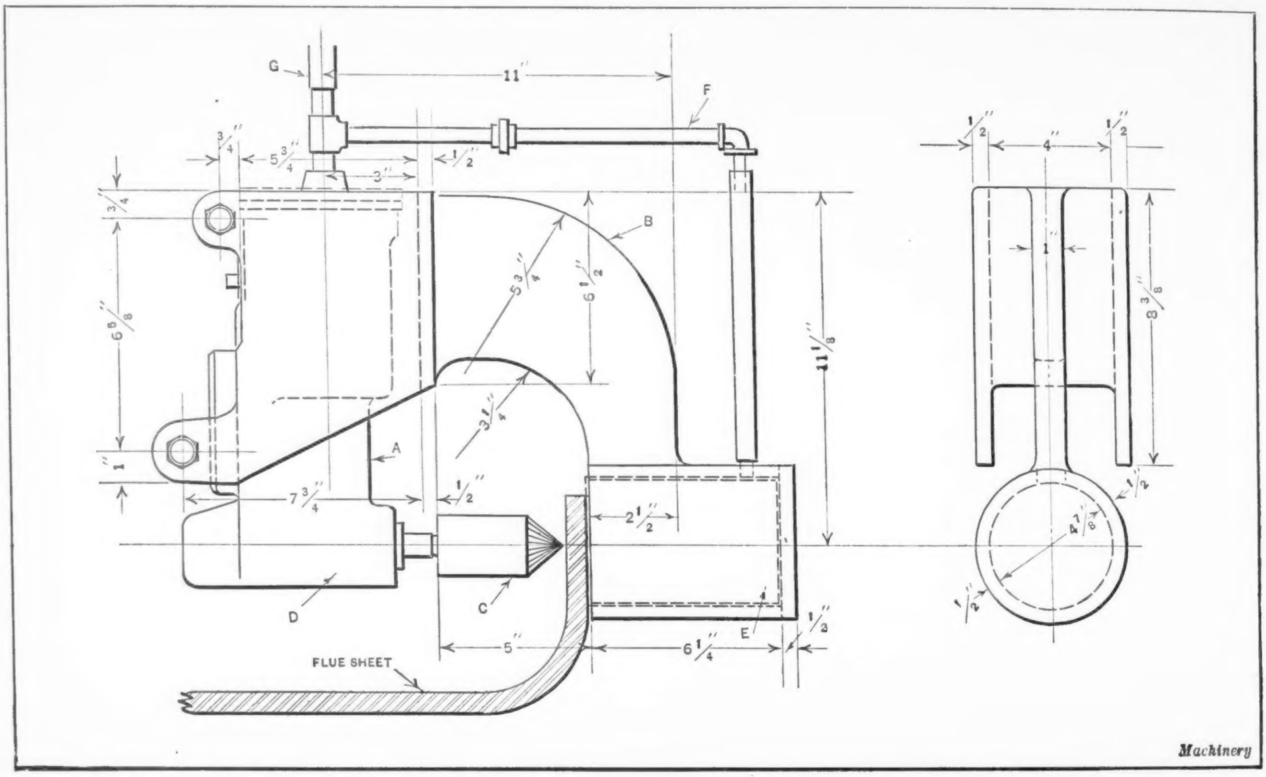
In a succeeding article the effect of changes in the temperature of the work during machining operations will be considered. The cause and effect of stresses in castings was dealt with in an article in October MACHINERY, page 121.

* * *

PNEUMATIC COUNTERSINKING TOOL FOR RIVET HOLES IN FLUE SHEET FLANGES

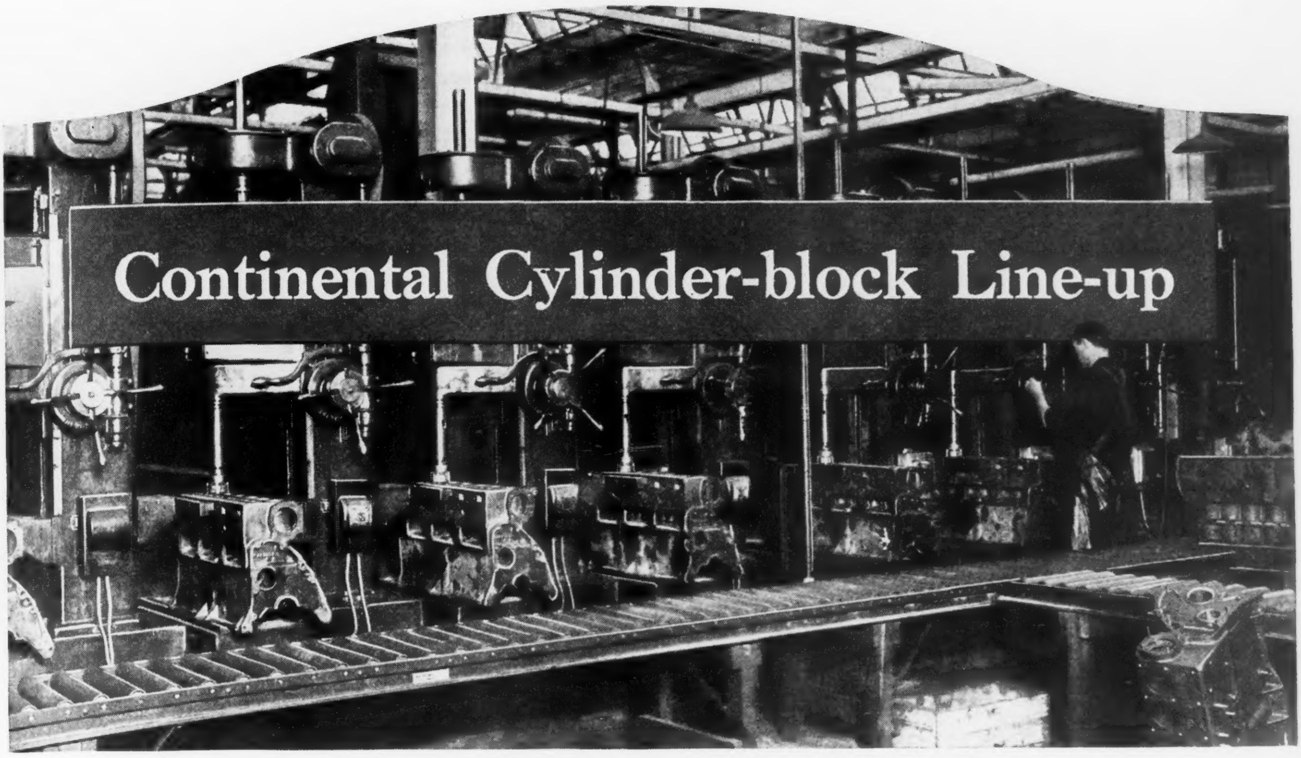
By E. A. MURRAY, Shop Superintendent, The Chesapeake and Ohio Railway Co., Huntington, W. Va.

The rivet holes in the flanges of boiler flue sheets cannot be countersunk efficiently by using ordinary tools, because there is little space between the row of rivet holes and the main body of the flue sheet. In the Huntington Shops of the Chesapeake and Ohio Railway Co., the pneumatically operated countersinking tool shown in the accompanying illustration is being used effectively for this class of work.



Air-operated Countersinking Tool for Countersinking Rivet Holes in Flue Sheets or Other Flanged Parts

This tool consists of a standard or commercial corner drill *A* (sometimes called "close-quarter" drill). This corner drill is clamped to arm *B* and is provided with a standard countersink *C*. The countersink is operated by the motor in the usual way, and derives its feeding movement from the air cylinder *E*, which is proportioned to exert the correct feeding pressure on the countersink. The air for this cylinder passes through pipe *F*, and is obtained from the air line connecting with the motor. When the air pressure is turned on, the pressure in cylinder *E* pushes the piston out against the sheet, exerting the proper feeding pressure on the countersink. A section of a flue sheet is included in the illustration to show how this tool is used, and to indicate its usefulness for this class of work.



Continental Cylinder-block Line-up

Methods Employed in Machining the Cylinder Block for a Six-cylinder Automobile Recently Brought Out

By CHARLES O. HERB

ANY concern that tools up for an entirely new product finds it feasible to adopt the best manufacturing methods, as determined by years of experience, and is in an admirable position to reduce costs and eliminate the disadvantages of old methods. An opportunity of this sort was afforded to the Continental Motors Corporation, Detroit, Mich., several months ago when contracts were closed for manufacturing the six-cylinder engine of an automobile since placed on the market by a well-known company. Many new machines were purchased for the production of this engine, and they have been installed in such a manner as to give maximum output with minimum labor. Important equipment of the cylinder-block line-up will be described in this article. The machines of this group are arranged for a production of 300 cylinder blocks per ten-hour day.

Roller Conveyors Reduce Manual Labor

With a view to reducing the fatigue of operators as much as possible, steel-roller conveyors of the construction seen in the heading illustration have been provided to carry the work from machine to machine. In many cases, the jigs with which the machines are equipped have also been furnished with rollers to facilitate the loading and unloading of work. There are only one or two instances where it is necessary to lift the cylinder blocks, and in those cases overhead hand-operated

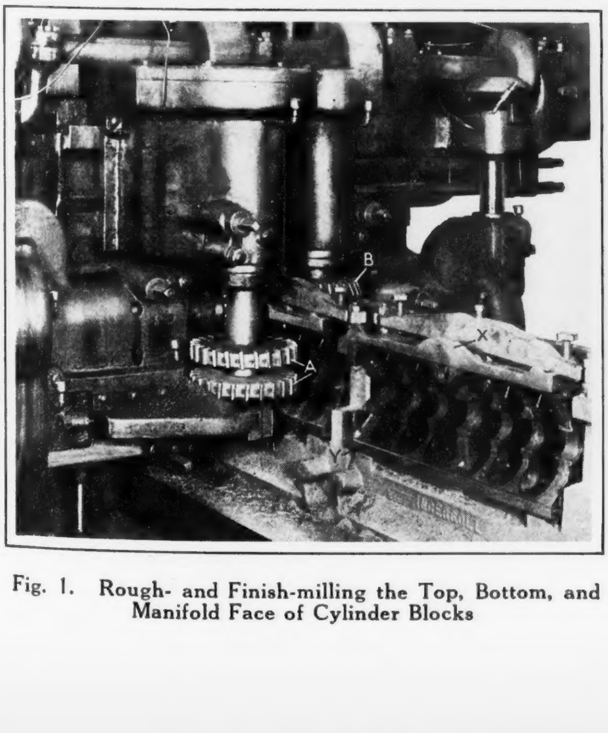


Fig. 1. Rough- and Finish-milling the Top, Bottom, and Manifold Face of Cylinder Blocks

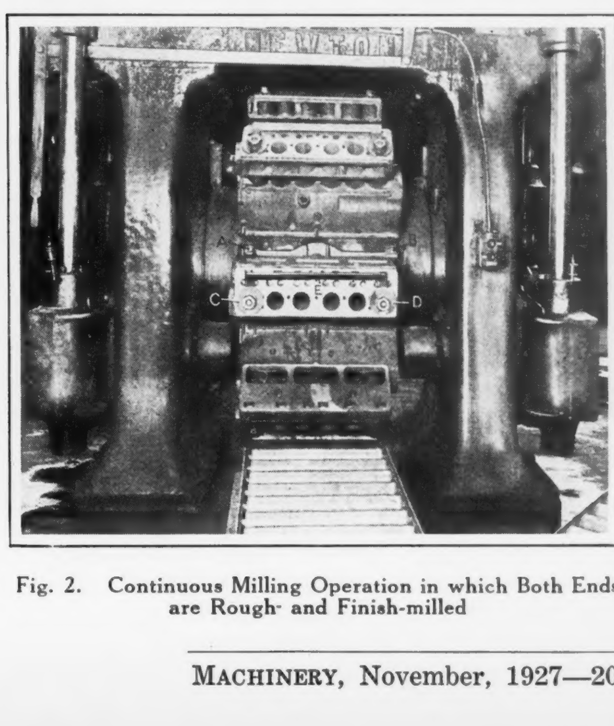


Fig. 2. Continuous Milling Operation in which Both Ends are Rough- and Finish-milled

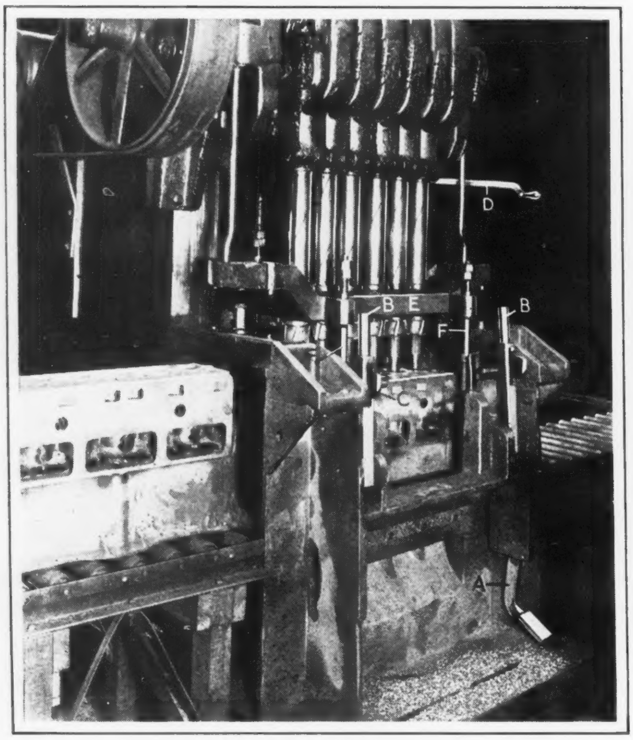


Fig. 3. Type of Equipment Employed for Rough- and Finish-boring the Six Cylinder Bores

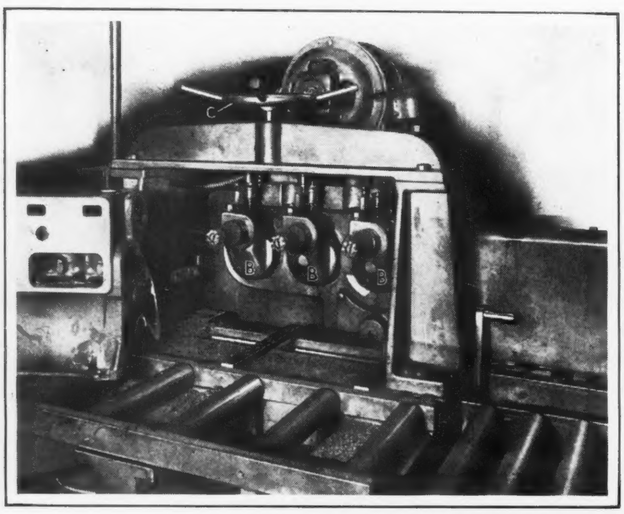


Fig. 4. Machine Equipped with Three End-mills which Revolve Eccentrically for Finishing Two Pads Each

chain hoists are supplied. The conveyors deliver the work on a level with the machine beds or tables. All machines are equipped with convenient push-button stations for controlling the individual driving motors.

Before any machining is done, each cylinder casting is inspected by means of a fixture, to insure that there is sufficient stock at all points to permit the various surfaces to be finished to the specified dimensions. The first operation consists of milling various surfaces in an Ingersoll adjustable rail type machine, and the casting is located in the inspection fixture in the same manner as that in which it will be held for this operation. Each casting is marked with chalk to indicate how much it should be shimmed up in the milling machine.

Milling Operations on Sides and Ends

Cuts are taken on three different sides of the cylinder block in the first operation, the castings being mounted in five fixtures on the machine table, as shown in Fig. 1. Six roughing cutters are provided at the front of the machine housing, and five finishing cutters at the rear. Cutters *A* at the front mill the crankshaft bearing-cap slots on the bottom side of the cylinder blocks, while two cutters revolving on horizontal axes immediately behind cutters *A*, mill bottom flanges *X* and *Y*. Cutter *B* rough-mills the manifold face, and a large cutter revolving around a horizontal axis mills the top of the cylinder blocks, which faces toward the right-hand side of the table. All these roughing cutters have stellite blades and remove about 1/8 to 3/16 inch of stock.

As each cylinder block reaches the back side of the housing, a milling cutter large enough to reach both surfaces *X* and *Y*, finishes these two surfaces in one plane. Two cutters that are duplicates of cutters *A* finish the crankshaft bearing cap slots, while a cutter of the same type as cutter *B* finishes the manifold face. The fifth cutter at the rear side of the housing finishes the top of the cylinder blocks.

All finishing cutters are provided with high-speed steel blades and remove approximately 0.025 inch of stock. Both the roughing and finishing cutters are set up by means of a templet block mounted at one end of the table. Gaging bars of two different thicknesses for the roughing and finishing cutters are used in conjunction with these templets. Three machines equipped as described in the foregoing have been installed for performing this operation.

Two holes are next drilled and reamed in one bottom flange for locating the casting in subsequent operations. The holes are produced simultaneously by two drill spindles which are fixed as regards center-to-center distance. While the location of the holes may vary slightly, the distance between them must not.

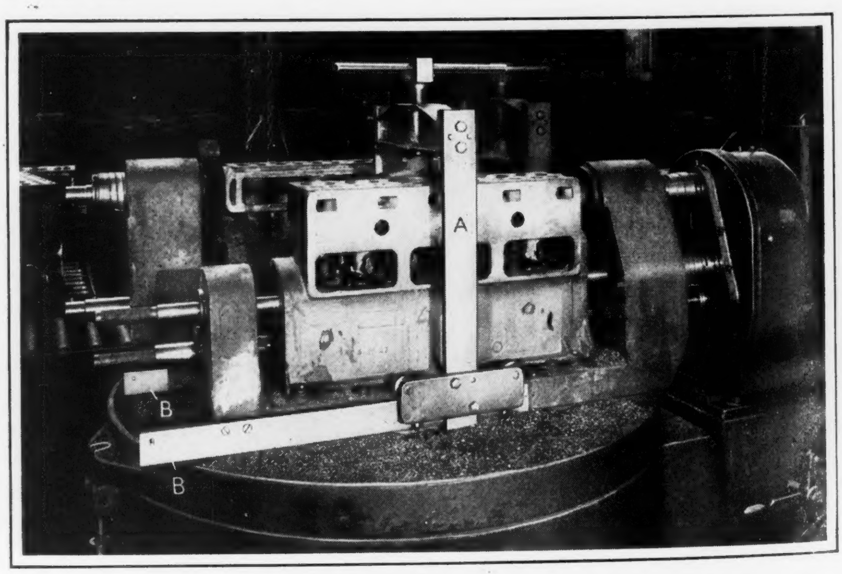


Fig. 5. Boring Camshaft and Crankshaft Bearings, and Water-pump Chamber

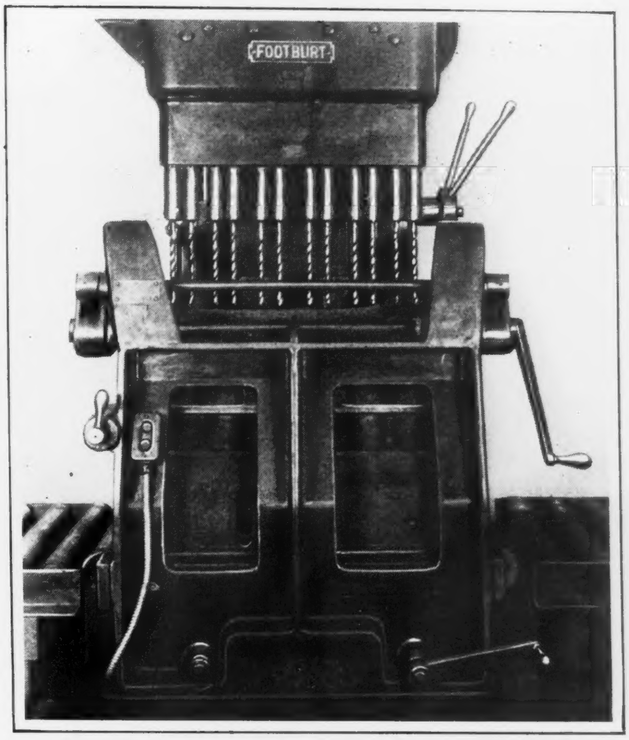


Fig. 7. Drilling the Valve-stem Guide Holes

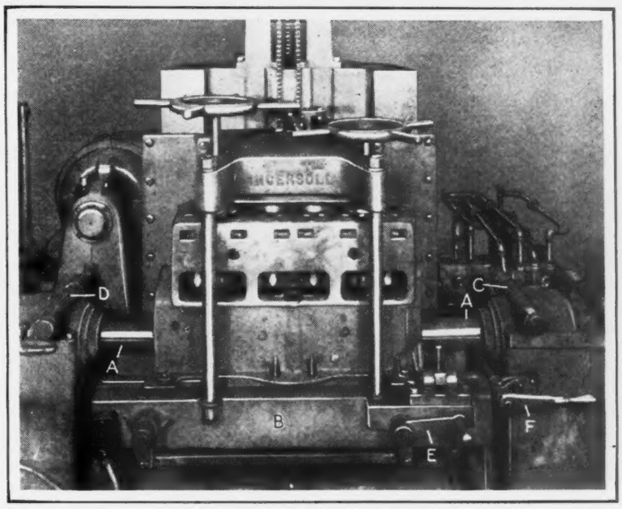


Fig. 8. Facing Main Bearings and Cutting an Oil-groove

The cylinder blocks next reach the Newton continuous drum type milling machine illustrated in Fig. 2, in which both ends are rough- and finish-milled by means of five cutters at the rear of the machine. Accurate location of each casting is obtained by slipping the previously reamed holes over plugs *A* and *B*. Each casting is held on the revolving drum by means of a bar *E*, which is slipped over the ends of two posts fastened to the drum and extending through the end bores of the cylinder block. It is merely necessary to tighten nuts *C* and *D* on the large collar-like ends of bar *E* in order to hold a cylinder block in place, the nuts engaging threads on the ends of the posts.

One roughing and one finishing cutter are used in succession on the front end of the cylinder at the same time that two roughing and one finishing cutter mill the large face on the rear end. The roughing cutters of this machine are also provided with stellite blades, and the finishing cutter with blades made of high-speed steel.

Rough- and Finish-boring the Cylinders

All six bores of the cylinder blocks are next rough-bored simultaneously in a Moline "Hole Hog" machine equipped as illustrated in Fig. 3. An identical machine and equipment are then used for the finish-boring operation on these holes. Three roughing and three finishing machines give an output of thirty castings per hour. Approximately 3/32 inch of stock is removed by the roughing tools and 1/32 inch by the finishing tools.

The jig furnished for each of these boring machines has several unusual features. It has a number of steel rollers, arranged as a table, which are on a level with the rollers of the conveyor when the jig is in the loading position. However, before the actual boring commences, the roller table is lowered so as to place the cylinder on solid supporting surfaces with the reamed locating holes over accurate fixed plugs. In loading the jig, treadle *A* is depressed, thus raising a bar which stops the cylinder block approximately in the correct longitudinal position. The machine is then started, and when the cylinder block reaches its supporting surfaces, the operator swings handles *B* upward over bars *C*, to clamp the casting securely in place.

The operation of the machine is started by moving handle *D*, the spindle head moving downward at a fast rate until the boring tools are close to the work, at which time a slow feed is engaged for the actual cutting. When the operation has been completed, the spindle head reverses at a fast rate. The boring-bars are guided by bushings in holder *E*, which is raised and lowered with the head, and also by bushings in the bottom of the jig into which the lower ends of the boring-bars extend. The upper ends of these jig bushings reach almost to the under side of the cylinder bores. During the re-

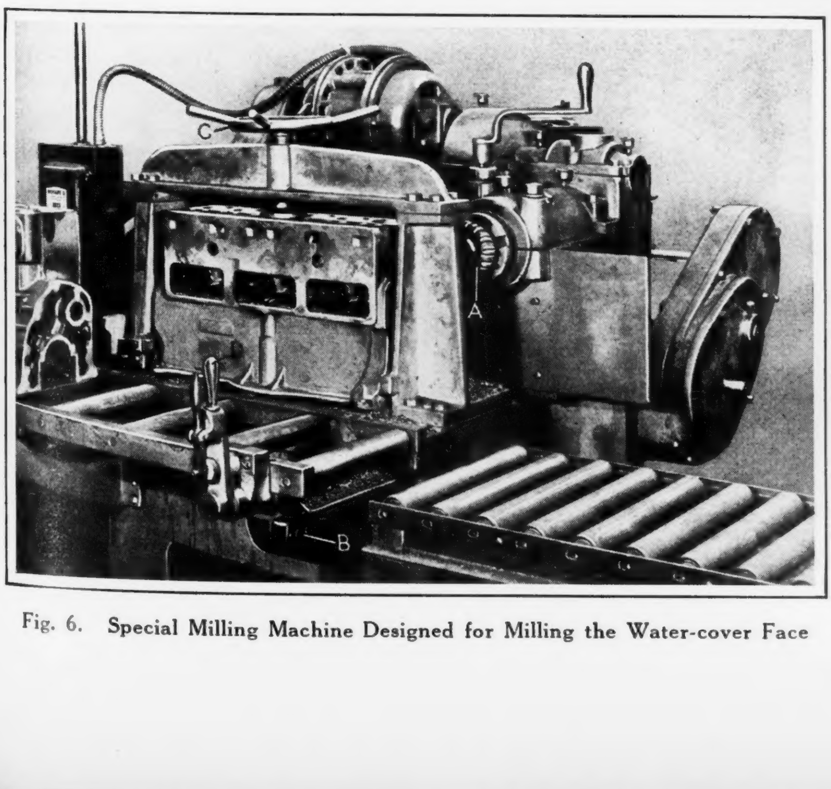


Fig. 6. Special Milling Machine Designed for Milling the Water-cover Face

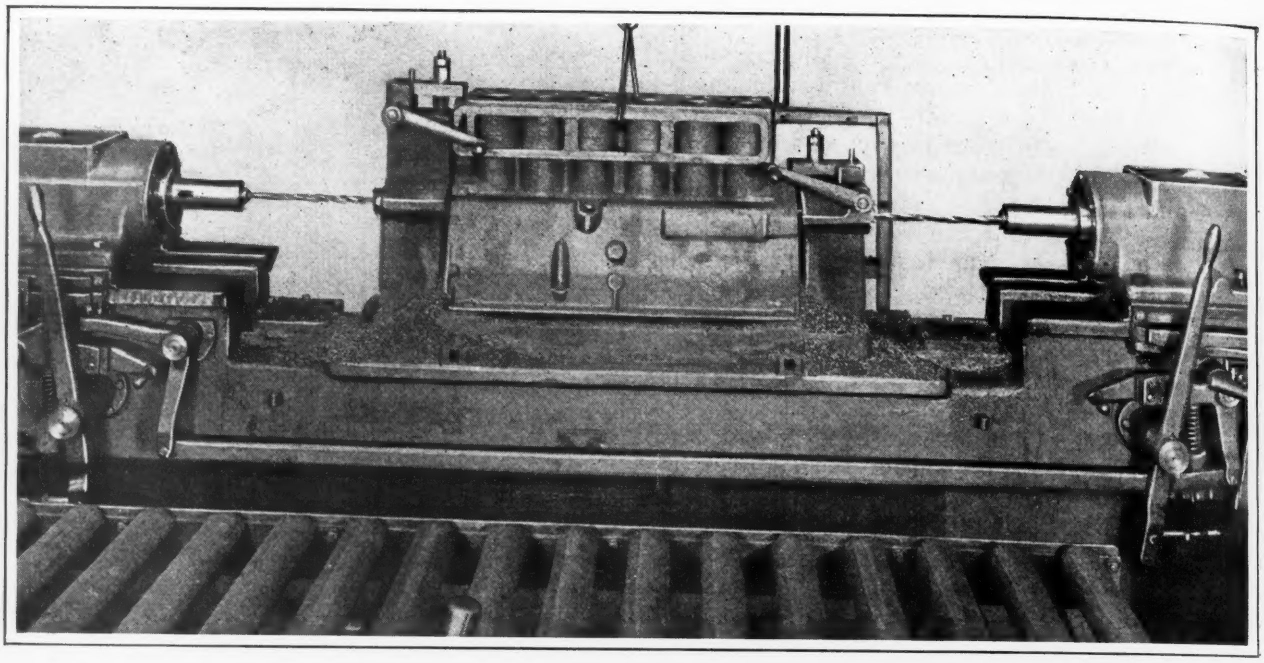


Fig. 9. Use of Long Drills for Producing a Small Hole Thirty Inches Long

turn of the spindle head, upon the completion of the operation, rods *F* raise bars *C* and throw handles *B* forward, thus automatically unclamping the work. The roller table is also again raised to the level of the conveyor. This table is moved vertically with the head, being attached to the bushing plate by four guide bars.

Machining the Main and Camshaft Bearings

After the water-cover face has been milled along one side of the cylinder block and the block has been subjected to a water test to detect any flaws which may have been uncovered in the machining operations thus far performed, the casting is brought by the conveyor to a Colburn upright drilling machine. Here it is placed in a swivel type of jig, which permits one casting to be loaded while another is being machined, so that the new casting can be swung into place beneath the machine spindle as soon as the first casting has been finished. The operation consists of rough-drilling the camshaft bearings. Four boring-bars, with special "Eclipse" cutters inserted in the end, are pushed through the bearings, each bar being connected to the machine spindle after the cylinder block has been swiveled into line with the spindle.

The Rockford horizontal drilling and boring machine illustrated in Fig. 5 is then employed for finish-boring the camshaft bearings, rough-boring the crankshaft bearings, and finish-boring the water-pump chamber. This machine is also equipped with a double jig, so that while the operation is in progress on one cylinder block, another block can be loaded in the other half of the fixture, and boring-bars inserted, ready to be connected to the machine spindles when the first casting has been completed.

An interesting feature of the jig consists of clamping device *A*, which is provided at the lower ends with rollers. Each pair of rollers runs on a track *B* so as to enable the clamping device to be readily moved on and off the cylinder blocks.

Three Milling Machines of Special Design

The milling of the water-cover face, which is done prior to the boring of the camshaft and crankshaft bearings, is accomplished by means of the special Ingersoll milling machine illustrated in Fig. 6. The milling is performed by means of cutter *A*, which is mounted on a head fed horizontally along the cylinder block. Milling can be performed with the cutter-head feeding either to the right or to the left, the drive to the cutter and to the cutter-head being suitably arranged.

Control of the operation is afforded through push-button station *B* at the right-hand end of a roller table which is embodied in the machine so as to give a continuation of the roller conveyor. Handwheel *C* is tightened to clamp the cylinder

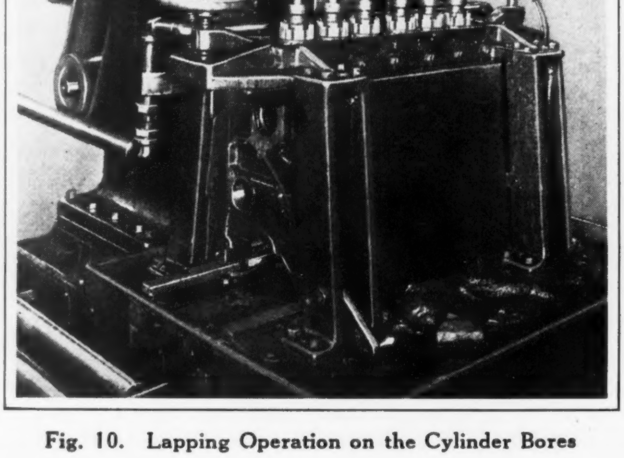


Fig. 10. Lapping Operation on the Cylinder Bores

block in the jig, after two plungers have been raised by means of lever D into the reamed locating holes of one bottom flange. In this operation, the stellite cutter is fed at the rate of 20 inches per minute, removing about 3/16 inch of stock.

Fig. 4 shows another Ingersoll machine equipped with three end-mills for finishing six valve-guide bracket bosses, such as seen at X. The cylinder block is, of course, pushed into the fixture with bosses X toward the cutters, and is accurately located for the operation by lowering handle A, which raises plungers into the locating holes in the bottom flange. During the milling, each of the cutter-heads B revolves an end-mill eccentrically, so as to mill two bosses without either the work or the cutters being moved horizontally. A single handwheel C is again tightened to clamp the work with a stop on the return movement. Lever E raises plungers into the locating holes in the bottom flange, and depresses these plungers upon the completion of the operation.

Various Drilling, Boring, and Reaming Operations

Three Foote-Burt multiple-spindle drilling machines and a Moline multiple-spindle drilling machine, all of upright construction, are used in succession for rough-boring the valve openings and spot-drilling the valve-stem guide holes; completely drilling the valve-stem guide holes; and rough- and finish-reaming these holes.

Fig. 7 illustrates the machine used in the second of these operations. The jigs of the various machines differ slightly, but each one is provided with a roller track which is lowered by means of a handle after the cylinder block has been pushed into place, so as to seat the block on substantial supports with the locating holes of the bottom flange over accurate plugs.

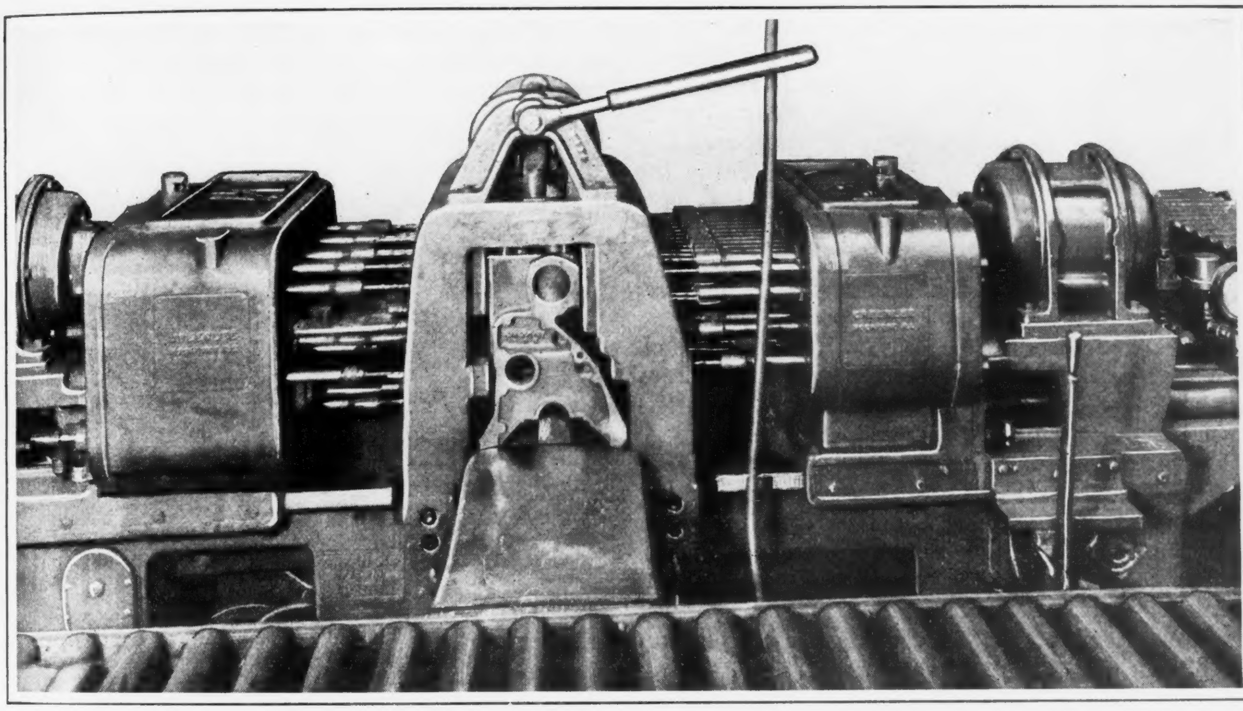


Fig. 11. One of a Battery of Horizontal Multiple-spindle Drilling and Tapping Machines

for the operation. Steel rollers are also supplied on this machine to make the conveyor continuous.

A third special Ingersoll milling machine is shown in Fig. 8. This machine is used for straddle-milling the faces of the main bearings and for cutting an oil-groove in the rear filler block. Twelve cutters are employed for the main bearing faces, and these are arranged with the groove cutter on the horizontal arbor A. For performing the operation, the cylinder block is lowered to the cutters by feeding fixture table B downward, the table being shown at the bottom of its stroke and ready to return the cylinder block to the same level as rollers C and D. Two of these rollers are mounted on each bearing of the cutter-arbor on the same plane as the conveyor rollers.

The vertical movements of table B are effected through an Oilgear hydraulic feed. There is a rapid downward movement of the table approximately to the milling point, then a slow feed during the actual cutting, and finally a rapid return. Handle F is used to start this mechanism at the beginning of an operation, the feed being automatically disengaged when the table comes in contact

Fig. 9 shows a W. F. and John Barnes double-head machine used for drilling a 19/32-inch hole for a length of approximately 30 inches, a special twist drill being employed from each end of the cylinder block. Both drills are advanced together until they come within about 1 inch of each other, at which time one drill rapidly recedes from the hole, while the second continues advancing until the hole has been drilled through. The long hole produced serves as the main oil supply line. Operation of the machine is entirely automatic after it has been started.

Three Greenlee horizontal multiple-spindle drilling machines of the design shown in Fig. 11 are used successively for drilling holes in both ends, in both sides, and in the top and bottom of the cylinder block. Three machines of the same type are then used for tapping many of the holes produced by the drilling machines. Fig. 11 shows the second of the drilling operations, a total of 104

holes being drilled. Each machine is provided with an Oilgear hydraulic feed for moving the spindle heads to and from the work. The cylinder block is clamped by merely operating the overhead lever.

Final Operations on the Cylinder Bores

After the performance of miscellaneous operations, the cylinder block reaches the group of eight Foote-Burt single-spindle machines appearing in the heading illustration. Here each bore of a given block is individually finish-reamed by the same tool, from 0.001 to 0.0015 inch of stock being left for the lapping operation. By reaming each hole separately without clamping the block, the tool is permitted to follow the bore and by using the same reamer on all bores, each one is produced as closely as possible to the same diameter.

The cylinder blocks are pushed directly through the bore reaming machines to the Moline automatic lapping machine shown in Fig. 10. This machine is equipped with "Hutto" segmental expanding "grinders." The cylinder block is positioned from the locating holes used in many of the preceding operations, and is clamped down by tightening the two handwheels. After the "Hutto" tools have been lowered into the bores, the machine is started. The spindle rail and slide then reciprocate the tools vertically a predetermined number of times and stop. When the cylinder block comes from this machine, each bore must be true within 0.0005 inch for out-of-roundness, and the bore must be straight for the entire length within 0.001 inch. Kerosene is used copiously in this operation.

Several other operations follow the lapping before the cylinder blocks are sent to the assembly department. One of these consists of reaming the main bearings and the babbitted camshaft bearings. Then the bearing caps are assembled, and the main bearings with the caps are line-reamed by means of adjustable tools, which are slipped and locked on a bar as it is pushed through the different bearings, the bar being piloted in a bushing at each end. This reaming bar is driven by applying a pneumatic drill to one end.

* * *

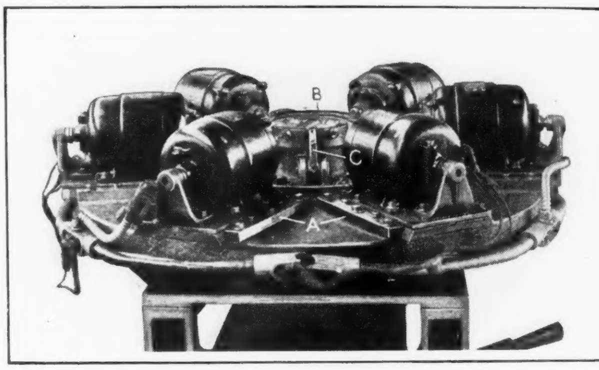
REHABILITATION OF RUSSIAN INDUSTRIES

According to a statement made by the Amtorg Trading Corporation, 165 Broadway, the Soviet Union has authorized the expenditure of over $600,000,000 for industrial improvements during the next twelve months. This is nearly 20 per cent more than similar expenditures during the fiscal year 1926-1927. More than 25 per cent of the amount appropriated will be used for the construction of new plants. These figures do not include appropriations of nearly $75,000,000 for new power plants. During the past fiscal year the Amtorg Trading Corporation purchased equipment in the United States valued at over $25,000,000, an increase of 60 per cent over the previous year. Last year industrial production in the Soviet Union exceeded the pre-war rate and showed a gain of about 20 per cent over the previous year. Only the metal and ore-mining industries are still below the pre-war level. Of the funds allotted for the new fiscal year, about $175,000,000 has been appropriated for the metal industries.

DRILLING SIX RADIAL HOLES AT ONE TIME

The baseplates of one type of automobile "Stabilators" manufactured by the John Warren Watson Co., Philadelphia, Pa., have six No. 28 holes drilled radially in their periphery. These holes are produced by means of a special machine equipped with motor-driven drill heads which are fed together toward the center of the machine to perform the operation. The arrangement of the drill heads is shown in the illustration.

Each head is mounted on a slide which is traversed toward and away from the center of the machine on dovetailed ways, such as seen at *A*. The motors of the drill heads are of 1/6-horsepower rating and run at 1725 revolutions per minute. Power for traversing the drill heads is derived from a 1/3-horsepower motor running at 1140 revolutions per minute, which is mounted on a bracket near the base of the machine. The drive is transmitted through a Johnson friction clutch to a reduction unit having a ratio of 24 1/2 to 1.



Special Machine Employed for Drilling Six Holes Radially at One Time

From this reduction unit, the drive is transmitted to a shaft on which a plate cam is mounted, and as this cam revolves, it causes a vertical shaft to reciprocate up and down.

Near the upper end of the vertical shaft there is a collar having six jaws to which are attached links which, in turn, are connected to bellcrank levers engaging small rollers fastened to the drill head slides. Therefore, as the vertical shaft pulls the collar downward, the toggle arrangement formed by the links and bellcrank levers moves the slides toward the center of the machine for the drilling operation. Conversely, as the vertical shaft moves the collar upward, the toggle mechanism moves the slides radially outward.

The work is held in jig *B*, being located by means of a finger in the jig. It is automatically gripped by means of three clamps *C* which are swung on the work as the collar on the vertical shaft is moved downward. By this means, the work is held securely and concentrically during the drilling, insuring the holes being drilled radially with the true center; otherwise, the spacing of the holes at the periphery would vary and spoil the interchangeability of the part. Automatic release of the clamps is accomplished simultaneously upon the return of the drill heads. With each complete cycle, a cam throws out the friction clutch. Engagement of the latter may be effected through a foot-treadle; in practice, however, this treadle is held down continually, as in an automatic punch press.

Notes and Comment on Engineering Topics

The use of electricity in this country is increasing at a marked rate. During the first half of this year, the output of public utility power plants was nearly 10 per cent greater than for the same period last year.

What is said to be the largest dam, in cubic contents, in the United States and possibly in the world will be built by the Lexington Water Power Co., ten miles west of Columbia, in Lexington Co., South Carolina. The dam will be the central unit of a water power development furnishing 200,000 horsepower. It will create an artificial lake 30 miles long and 14 miles wide.

During the past summer the Bureau of Labor Statistics has conducted an investigation into the efficiency of labor in different European countries, including Great Britain, Belgium, France, Germany, Czecho-slovakia, Austria, Switzerland, and Italy. The object is to determine, as accurately as possible, the actual output per man-hour in different industries, and by comparing this with the wages paid, to determine the real labor cost of production abroad.

According to a survey made by the Bureau of Foreign and Domestic Commerce, 40 per cent of the automobiles built throughout the world in 1926 were used for replacement purposes. The number of registered cars, buses, and trucks throughout the world increased during the year by approximately 3,060,000 units. During the same period, 5,090,000 motor vehicles were built. From this it is evident that 2,030,000 cars, or approximately 40 per cent of those produced, were required to replace cars retired from service during the year.

It is of great interest to observe that many differences between employers and employes are settled at present in a friendly manner and to the satisfaction of both sides. Over 500 industrial disputes were handled by the Conciliation Service of the Department of Labor during the fiscal year ending June 30. These disputes affected, directly or indirectly, half a million workers, and it is stated by the Director of Conciliation that more than 85 per cent of the cases handled resulted in satisfactory settlements. In most instances, industrial activity has not been interfered with during the period that the Conciliation Service has been active.

In a paper by F. J. Scarr, formerly supervisor of motor transportation, Pennsylvania Railroad, presented at the first annual meeting of the Motor Bus Division of the American Automobile Association, a comparison was made between railroad and motor bus transportation. The following fundamental principles involved in our entire system of transportation were emphasized: (1) Each mode of transportation must be used where economically suited. (2) Sound business organization and management must be maintained. (3) Complete coordination with other modes of transportation and other lines of traffic movement must be insured through cooperation and consolidation.

Among the more important future motor-transport developments, says *Motor Transport,* the general application of the Diesel engine to road-vehicle propulsion now seems more than probable. In view of its long success as an economical and reliable power producer for marine and stationary work, it is, in fact, surprising that it has not already become a competitor to be reckoned with in a field where the gasoline engine has gained so great a lead. Admittedly, the practical difficulties of adapting the Diesel engine to road-service conditions have been great enough to discourage the most intrepid designers when one considers the importance attached to weight and size reduction. That great progress has been made in this direction, however, can be gathered by the fact that Diesel and semi-Diesel engines suitable for aircraft propulsion have been constructed.

The Power River Co. of Vancouver, Canada, has installed a combination of General Electric control devices and warning signals to prevent failure of the lubricating system for its electric generator and to prevent overheating of the generator thrust bearing. On failure of the oil-pump, a spare pump is immediately started and an industrial signal sounded. A signal also sounds when the thrust bearing overheats. The oil-pump that is regularly used during the operation of the generator is driven through gearing from the generator shaft. An independent motor-driven oil-pump is also provided with an equipment for hand starting. Should the geared pump fail to operate, the motor-driven pump will go into service automatically.

A pressure switch is installed in the discharge side of the geared oil-pump. With this arrangement, if the pressure of the geared pump drops, the pressure switch closes a magnetic switch and thus starts the motor-driven pump. The second pump operates until normal conditions are restored and pressure is again delivered by the geared pump, whereupon the pressure switch opens its contacts and the motor-driven pump shuts down. On the closing of the pressure switch, an industrial signal sounds. The thrust bearing on the generator is equipped with a "Tycos" thermometer alarm control which operates a 125-volt, direct-current industrial signal. A special wiring scheme had to be arranged, because the contacts of the thermometer control are suitable for handling a very low voltage only.

Selecting the Right Size Press for a Job

DIFFICULTIES have always been experienced in selecting the right size press for a given job. No very definite rules have been available for this purpose, and any guidance that the mechanical man can obtain in selecting a press will doubtless be appreciated. The Toledo Machine & Tool Co., Toledo, Ohio, lists the following points to be considered. The selection may depend on:

1. The size and type of die required.
2. The length of stroke necessary.
3. The pressure required for doing the work.
4. The distance above the bottom of the stroke where this pressure first occurs.
5. Additional pressure required, due to attachments, such as are used for drawing work.
6. The method of feeding, the direction of feed, and the size of sheet, blank, or article.

The third item in this list can be determined as explained in the following: The pressure required for doing the work, if the work is punching or shearing, depends on the kind of material, its shearing strength, and the area sheared.

Punching and Shearing Pressures

Table 1 gives the approximate pressure, in pounds, required for punching and shearing different thicknesses of steel and brass plate. In punching, if pressures for other diameters than one inch are required, multiply the pressure for one inch by the required diameter. The figures in Table 1 are based on the following values: Shearing strength per square inch of mild steel = 50,000 pounds; shearing strength per square inch of high-carbon steel = 75,000 pounds; shearing strength per square inch of brass = 35,000 pounds.

Crankshaft Capacity

When the pressure occurs at or near the bottom of the stroke, with a comparatively short stroke, the tonnage given in Table 2 is safe for a given size of crankshaft, as all parts of a standard press are generally designed to withstand the listed pressure at the bottom of the stroke. At this point the crankshaft is under a bending load, similar to a beam. The tonnage figures do not apply to end wheel presses with an overhanging crankpin. The crankshafts referred to are forged from billets of about 0.45 carbon steel having a high elastic limit. The crankshaft diameters given are the frame bearing sizes of standard presses.

Table 1. Pressure, in Pounds, Required for Punching and Shearing

Thickness, No. of Gage, U.S. Std. Plate, or Inches	Punching: For 1-inch Diameter Hole without Shear on Dies			Shearing: For 1-inch Length without Shear on Dies		
	Mild Steel	High-Carbon Steel	Brass	Mild Steel	High-Carbon Steel	Brass
20	5,890	8,835	4,123	1,875	2,812	1,312
18	7,854	11,781	5,498	2,500	3,750	1,750
16	9,817	14,726	6,872	3,125	4,687	2,187
13	14,765	22,148	10,335	4,700	7,050	3,290
11	19,635	29,452	13,744	6,250	9,375	4,375
3/16	29,452	44,178	20,616	9,375	14,062	6,562
1/4	39,270	58,905	27,489	12,500	18,750	8,750
5/16	49,087	73,631	34,361	15,625	23,437	10,937
3/8	58,905	88,357	41,233	18,750	28,125	13,125
7/16	68,722	103,080	48,104	21,875	32,812	15,312
1/2	78,540	117,810	54,978	25,000	37,500	17,500
5/8	98,175	147,262	68,722	31,250	46,875	21,875
3/4	117,810	176,715	82,467	37,500	56,250	26,250
7/8	137,445	206,167	96,211	43,750	65,625	30,625
1	157,080	235,620	109,956	50,000	75,000	35,000

Machinery

Table 2. Capacity of Crankshafts at the Bottom of the Stroke

Crankshaft Diameter, Inches	Tons: Single-crank Press	Tons: Double-crank Press	Crankshaft Diameter, Inches	Tons: Single-crank Press	Tons: Double-crank Press
1 3/8	6	....	6 1/2	150	150
1 1/2	7.5	....	7	180	180
1 5/8	9	....	7 1/2	215	215
1 3/4	10.5	....	8	255	255
1 7/8	12	....	9	345	345
2	14	....	10	440	450
2 1/8	16	....	11	545	650
2 1/4	18	....	12	665	900
2 1/2	22	22	13	790	1150
2 3/4	26.5	26.5	14	920	1400
3	31.5	31.5	15	1060	1700
3 1/4	37	37	16	....	2000
3 1/2	43	43	16 1/2	1300	....
4	56	56	17	....	2300
4 1/2	71	71	18	1560	2700
5	88	88	20	1950	....
5 1/2	106	106	22	2380	....
6	126	126	24	2860	....

Machinery

When the pressure occurs at quite a distance above the bottom of the stroke or when a comparatively long stroke is required, as in toggle drawing presses, thereby increasing the effective crank arm, the load on the crankpin produces a torsional load on the crankshaft. This load on the crankpin is limited by the gearing and the amount of torsion that the crankshaft will safely withstand.

On some single-crank presses with a very long stroke, on double-crank presses of great width or with a long stroke, and on all large single- and double-crank presses, "twin gearing," or a gear on each end of the crankshaft, is employed. This arrangement increases the gearing strength and torsional capacity of the crankshaft, and in the case of wide double-crank presses, reduces the torsional deflection of the crankshaft. Under these conditions, the load at the bottom of the stroke would still be limited by the figures given in Table 2. In all cases where twin gearing is used, the press would be operated by a friction clutch.

When there is any doubt as to whether a given press will have sufficient capacity for the work it is proposed to do, it is advisable to communicate with the press manufacturer, giving him all the data available.

Methods of Holding Tools and Cutters

Chuck Drives and Fastenings—Floating Joints—Quick-acting Couplings

By FRED HORNER

BOTH the ordinary taper pin and the flattened wedge pin are sometimes referred to as cotters, but according to the original meaning of the term, a cotter is a flat tapered strip employed to unite a shank with its socket in the manner commonly employed in piston-rod design. This type of fastening was formerly used to a considerable extent in securing milling cutter shanks or arbors. Now the draw-bolt and clutch design, with means for obtaining adjustments by a wedge or inclined slot, is becoming more prevalent for this class of work.

Many reamers are expanded by the wedge or inclined slot method, as shown at *A*, Fig. 31. A nut is employed in this design to back up the blades. At *B* is shown a similar design having an adjusting nut and retaining collar at each end of the blades. The wedge arrangement for each blade of the reamer shown at *C* is comprised of two units secured by a stem in the tool shell. The amount of adjustment is indicated by the micrometer graduations.

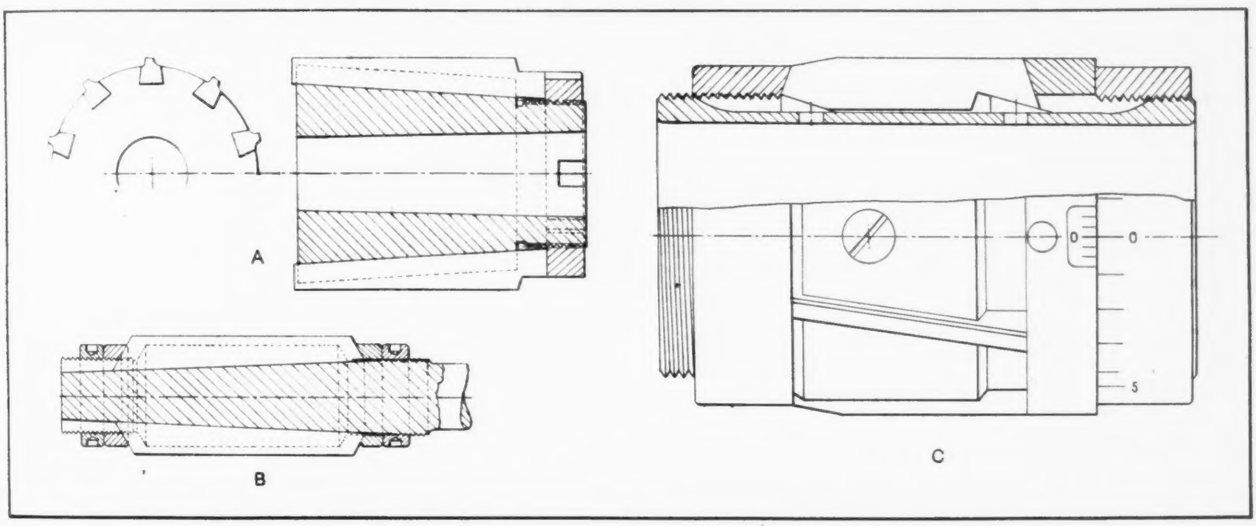


Fig. 31. Reamers Having Blades Adjusted by Inclined Slot and Wedge Arrangements

One method of obtaining size adjustments on boring-bars, which was employed successfully for some years, was to place two blades in slots inclined at diverging angles and adjust the blades simultaneously by means of a ring nut which engaged the rear ends of the blades. A modern tool of this type is shown at *A*, Fig. 32. The tool-holders shown at *B* hold the cutting bits *C*. A micrometer collar is employed, having graduations that permit the amount of adjustment to be read in thousandths of an inch. The shank is tapered at both ends, so that the tool can be driven from either end; this construction also enables extension bars to be used in either horizontal or vertical machines. A pilot end can also be employed if desired. A trepanning tool having similar slide fittings, but with split holders for clamping the tools, is shown at *D*.

Clutch Drives and Fastenings

Positive clutch drives which have proved so satisfactory for milling cutters are also used to some extent for smaller rotating tools, such as counterbores. At *A*, Fig. 33, is shown one of the simplest types of clutch drives employed on a counterbore. At *B* is shown a parallel flanged spindle design employed on milling machine spindles. With this construction, no trouble is experienced from freezing, and the cutter can be driven in either direction.

Arbors for shell reamers and mills are made either with a flat or round pin key or with clutch collars that engage the back of the tool, the collar being screwed or pinned on. Another method of securing milling cutters is shown at *E*. The arbor shown in the upper view has a slotted collar which is designed to be driven by the spindle of the machine. The arbor illustrated in the lower view has a clutch projecting member at the back of the flange.

Clutch fastenings furnish a means of obtaining a floating drive for reamers, taps, and dies, which is particularly adapted for turret lathe work. One design, known as the Oldham clutch, consists of a collar with teeth on opposite sides, as shown in the view at *C*. This design can be applied in two or three ways. A tool socket may be set loosely inside the holder with a retaining cap at the front end and a ring on the inside where it engages the socket; or a tool shank can be loosely held in position with the clutch placed over it. Another convenient arrangement, designed to avoid the use of long loose bars, has the reamer or tap only held loosely on the bar.

The clutch connection between milling cutters is used for one of two reasons, namely, to furnish a strong drive, as in the case of heavy gang slabbing mills, or to provide for adjusting the cutting width of interlocking mills by means of packing washers, inserted as shown in the view at *F*.

Fine-tooth clutches are also used for many circular forming tools to give a positive hold and facilitate adjustment. The teeth may be cut directly on the tool face or on a separate ring which is afterward pinned to the tool, as in the case of the design shown at *G*. The separate ring design is employed chiefly to facilitate the machining operations. Fine adjustment of the cutter shown at *D* is secured by the ratchet arm and adjusting nuts on the fixed stop. This tool is of the inverted type for use on the rear slide.

What may be termed a straight clutch is often employed for gripping certain types of tools held by the action of a wedge or screw. Both cylindrical cutters and those of square or diamond form are often secured with a serrated head, as shown at *E*, Fig. 34. The use of cam fastenings is very limited. One type, however—the tool-holder shown at *F*—is well known. This holder is self-tightening.

Floating Joints

In addition to the floating clutch design shown at *C*, Fig. 33, several varieties of floating tools or bars may be mentioned. The term "floating" usually implies a looseness sufficient to allow a tool to follow or be guided by the hole, but the adjustable type of holder shown at *H*, Fig. 33, is designed for use when it is desired to correct the alignment without permitting the tool to have any float after it is adjusted.

A very simple makeshift practice, when handling small lots of work having shallow holes, is to loosen the wedge pin of the ordinary double-end boring cutter in its bar, so that it will have sufficient float to clean up the hole to size. The two-piece flat-blade tool shown at *D*, Fig. 34, is based on this principle. The cutting blades of this tool are adjusted by means of the screw which passes through the lower blade. Screws having pilot points that enter grooves cut in the blades prevent the latter members from dropping out of the holder.

A somewhat similar design is made with the blades at the end of the bar. The smallest size reams holes 5/8 inch in diameter, and the largest, holes 5 inches in diameter. At *B*, Fig. 35, is shown a two-blade floating reamer of the collapsing type which permits the tool to be withdrawn without scoring the highly finished bore. The blades rest upon a hardened spherical plunger as shown at *E*. A slight lateral clearance in the hole gives the required floating action.

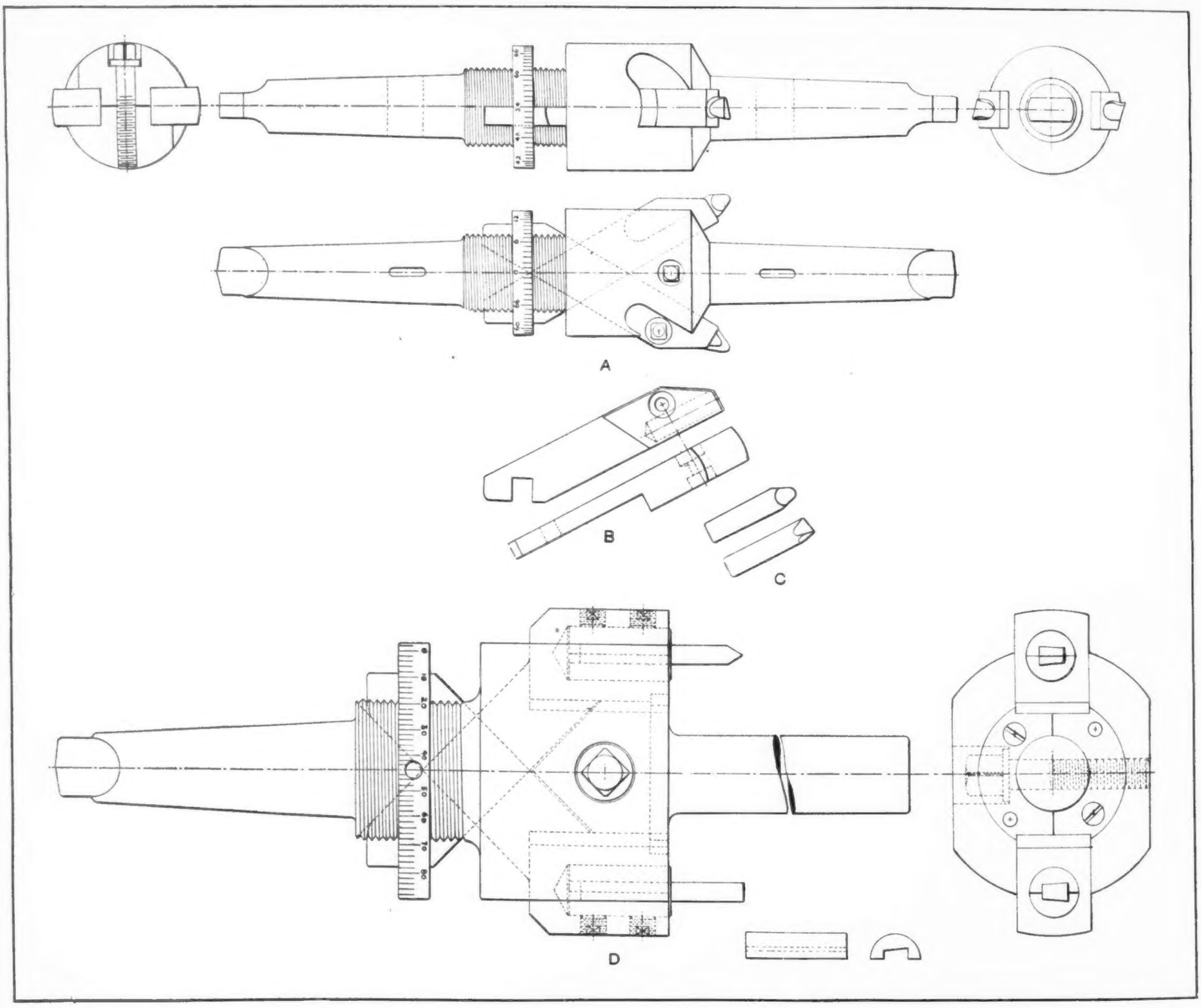


Fig. 32. Boring and Reaming Bar with Micrometer Adjustment, and Trepanning Tool with Similar Adjusting Arrangement

The pin F passes through the collar G and the stem H, the pin having sufficient clearance to permit it to turn and slide in the body of the tool. Hence, when collar G is revolved, member E is turned until two grooves in the latter member are positioned opposite the blades, which will then sink into the grooves under the pressure of the springs, one of which is shown at J in the end view. The contracting of the blades in this manner permits the tool to be withdrawn from the hole. The cutting size of the tool is adjusted by means of the collars K. The adjustment is obtained when the longitudinal position of member H is such that the tapered end E expands the cutters as required.

Floating shanks having simply a loose-fitting cross-pin which receives the end pressure on the tool have been used for many years. At A, Fig. 34, is shown a design in which the thrust is taken by the end of the holder at point J. Many holders are provided with a cone-pointed center which receives the thrust. At B is shown a holder of this type, which is fitted with an adjustable center thrust screw. At C is shown a holder in which the thrust is taken by a ball contact, which gives an excellent floating action. For tools employed on heavier work, a binding bolt device is often required. A holder of this type, designed to be bolted to the turret face, is shown at H.

The objectionable sagging that occurs in the case of heavy and long tool bars is sometimes overcome by placing springs below the bar to support its weight. Another method of preventing sag is illustrated at G, Fig. 34. This holder insures starting the tool correctly and also permits it to have an easy floating action in all directions. The holder and stem are united by four bolts having spherical heads and nuts. A strong spring separates the two members, so that the tool axis is not restricted to any definite position, but may float in any direction. A ball race placed behind the spring insures a free motion.

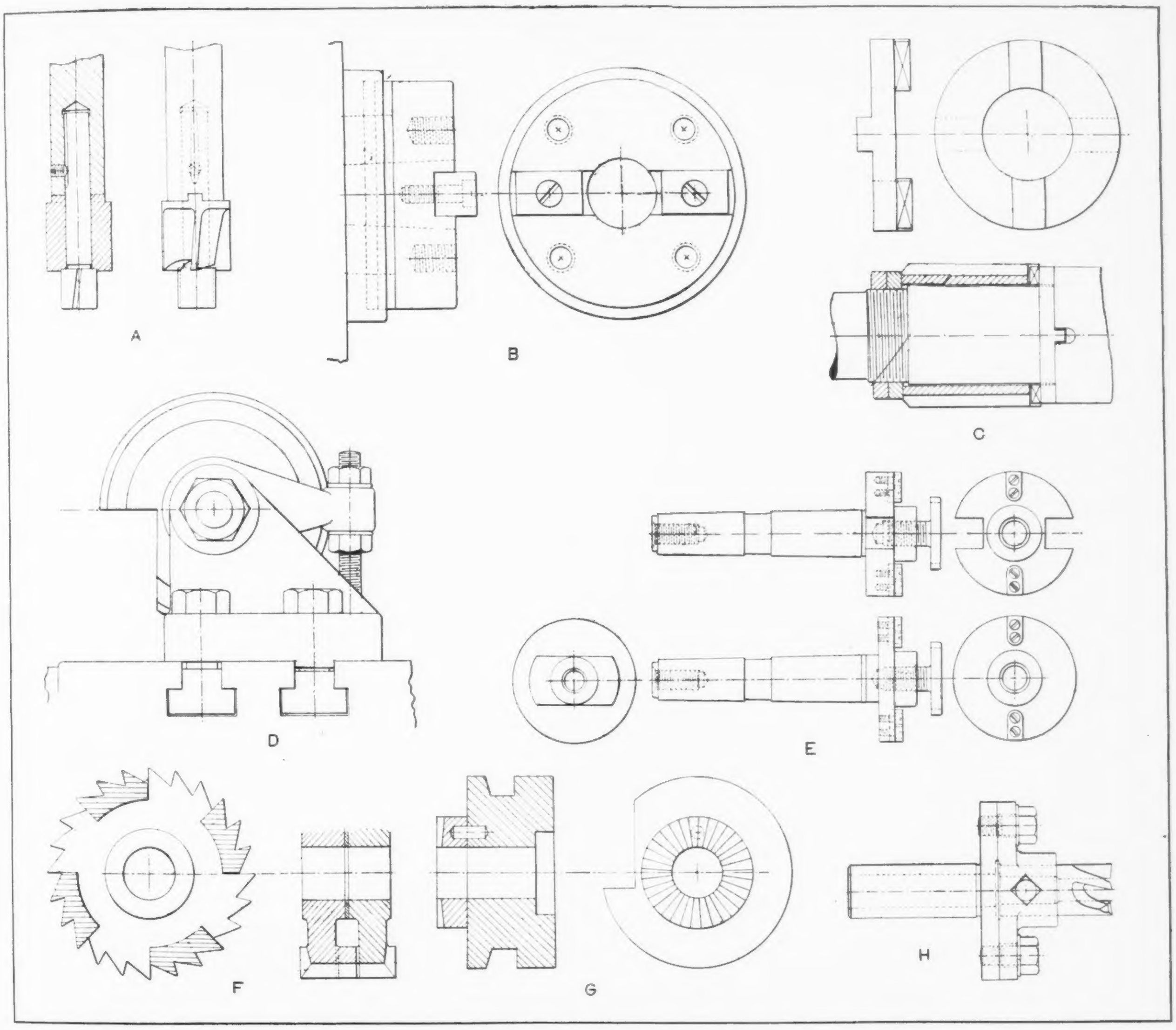


Fig. 33. Various Examples of Clutch and Other Adjustable Fastenings

Quick-acting Couplings

There is ordinarily no necessity for speed in disconnecting or coupling up tools, except in the case of drills, counterbores, and reamers employed in rapid succession. In such cases, the problem is generally solved by the use of a chuck, which may be of the non-stop variety. Broaching tools, which are in a somewhat different class from those mentioned, also require a joint that can be quickly connected and disconnected. A cotter-key joint may be utilized for this purpose, or with small broaches, a latch device may be used. A holder for a broach having a notch near its shank end which automatically engages the latch is shown at D, Fig. 35.

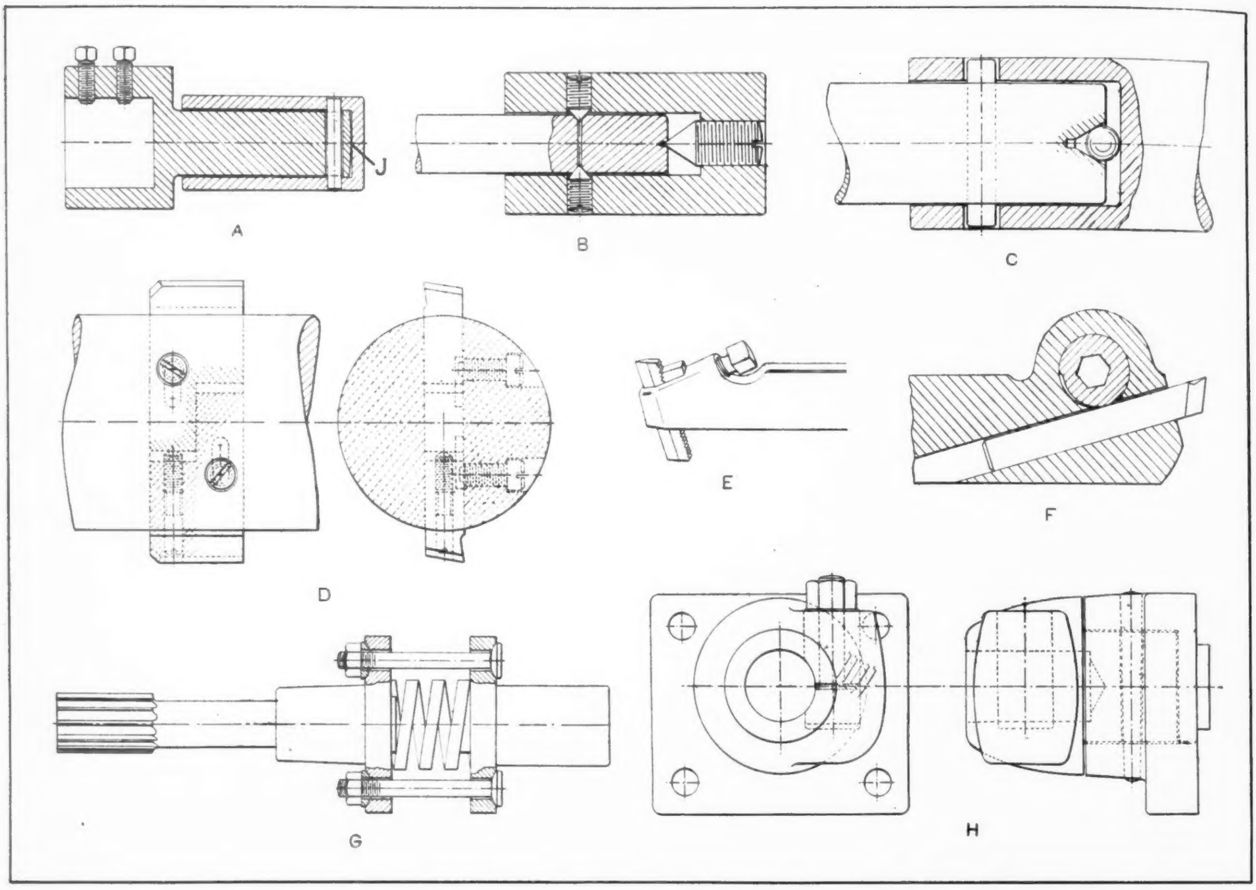


Fig. 34. Holders of Floating Design, and Holders with Positive Adjusting Means

On a certain type of machine built in England, all broaches are held by a necked-in end, which is gripped by a self-centering holder, as shown at *C*. This holder is composed of four jaws, separated by springs at the joints and held together by spring bands. A conical ring centered by three screws

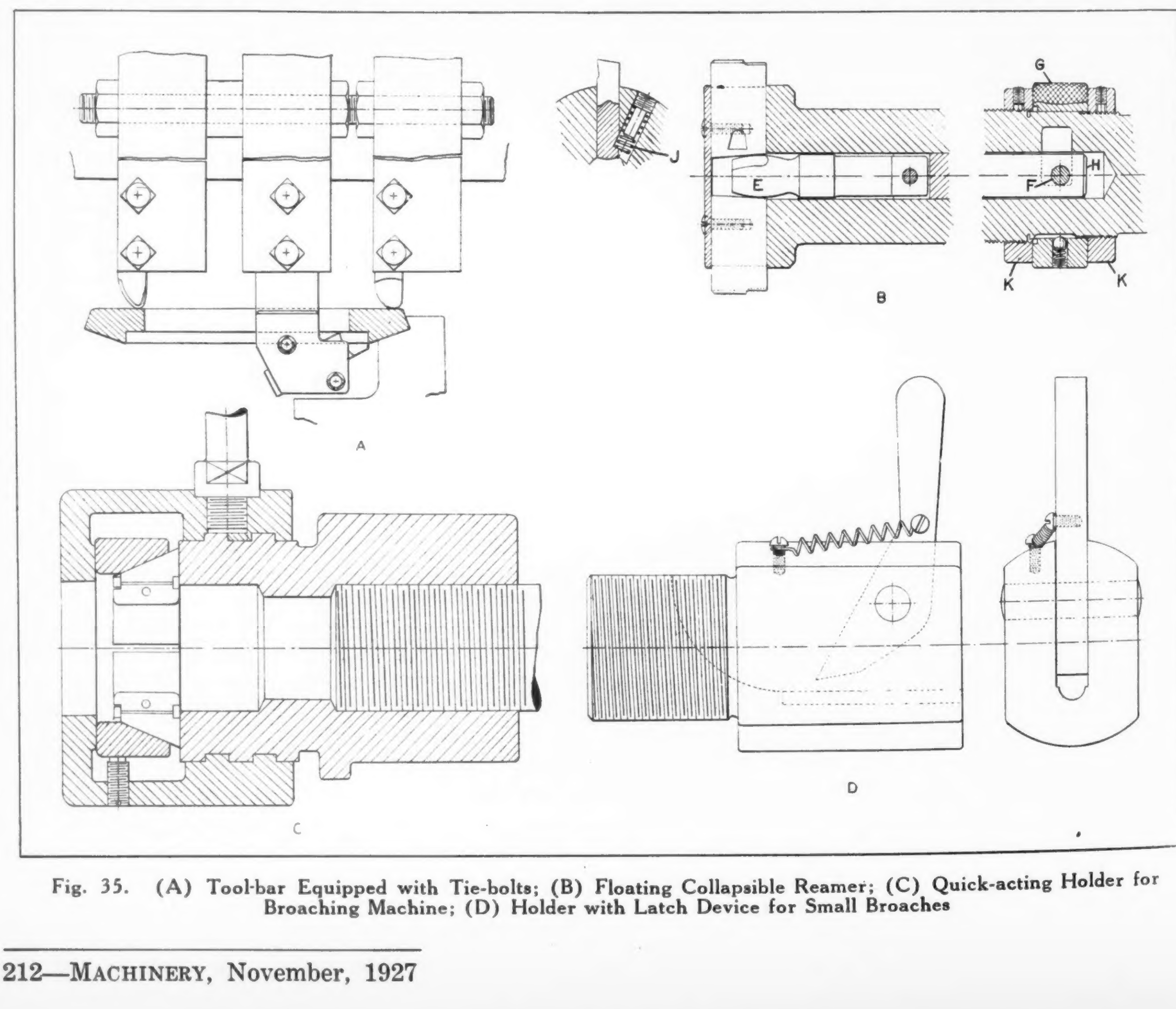


Fig. 35. (A) Tool-bar Equipped with Tie-bolts; (B) Floating Collapsible Reamer; (C) Quick-acting Holder for Broaching Machine; (D) Holder with Latch Device for Small Broaches

embraces the exterior cone surface of the clamps and closes them around the broach neck when the upright handle is pulled over. This action turns the shell on a thread having a quick lead, and forces the cone member over the clamping jaws. The action of a holder of this type is such that the broach can be attached or released very quickly.

Supports for Tools

The problem of supporting a tool properly is a vital question in many instances, especially when the tools are slender or have considerable overhang. Various arrangements of projecting lips, sloped or buttressed front surfaces, and sometimes screw-jacks placed under the tools are employed. Narrow tools may often be supported by thinner blades placed beneath them, while rack-shaped tools, such as used in gear-tooth generating machines, may be clamped on back-plates of a corresponding shape. When back-plates of this kind are employed, the tool can be used, even after it has been ground thin by repeated sharpening. Tie-bolts are also used to support tools, as in the case of the design shown at *A*, Fig. 35.

This is the last of a series of articles on methods of holding tools and cutters, which started in December, 1926, MACHINERY.

* * *

X-RAYS USED TO IMPROVE CASTINGS

The rays from an X-ray apparatus developed at the Watertown Arsenal, Watertown, Mass., penetrate 3 1/2 inches of metal in thirty minutes. The X-ray method is used for detecting defects in castings that do not appear on the surface. From 75 to 90 per cent of the defects in castings are due to mistakes that occur in molding or in making the designs, and most of them are preventable, according to Dr. H. H. Lester, of the arsenal.

The apparatus reveals cavities caused by gas and by water vapor due to wet sand in the mold, and also by shrinkage of the metal as it solidifies. Cavities caused by shrinkage occur because the design does not provide for a sufficient excess of molten metal in "risers," or enlarged portions, to compensate for the shrinkage. Cracks that do not appear on the surface of castings are also revealed.

The process of taking photographs by X-rays is called radiography. Another interesting application is the study of the atomic structure of metals. This is called X-ray metallography. By using the rays in certain ways, photographs can be obtained that make it possible to tell the relative position of different kinds of atoms in the metal and how the crystals behave individually when force is applied to bend, stretch, or compress the metal.

The X-ray tube room at the arsenal is lined with twelve tons of lead to protect the operator, who looks into it through a periscope. As a result of the use of the apparatus at the arsenal, the number of castings and other parts rejected because of defects has been reduced by correcting the causes and, as a consequence, the cost per pound of manufactured castings has been going down steadily.

Radiographic units, which cost about $10,000 complete, have also been installed by the U. S. Bureau of Standards in Washington and by the University of Michigan at Ann Arbor.

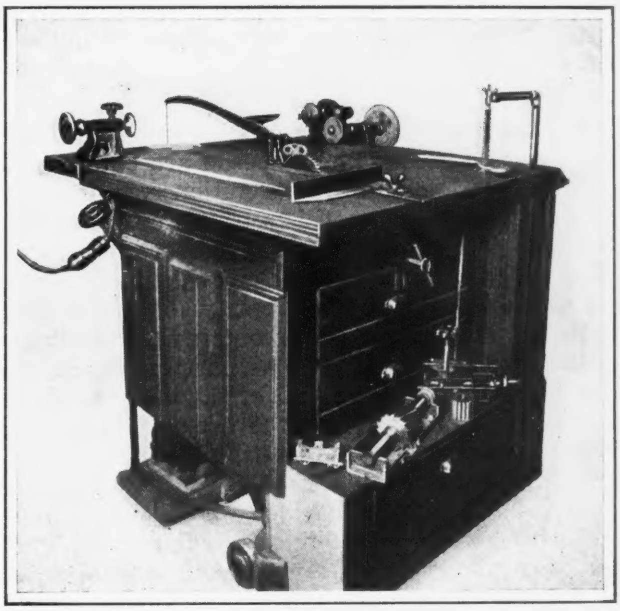
WORK-TABLE WITH POWER TOOLS

By A. G. BLACK

An interesting shop tool in the form of a combination work-table and power-driven wood- and metal-working tools, which was built by the writer, is shown in the accompanying illustration. This table is equipped with a circular saw, a buzz planer, a 6-inch emery wheel, a 6-inch bench lathe for both wood and steel turning, and two jig saws, one for light scroll work and one for heavier work. These tools are driven by a 1/4-horsepower motor, which runs at a speed of 1725 revolutions per minute.

Odds and Ends Used in Construction

The whole outfit is made up from odd parts, such as are generally thrown away. From a casual inspection of the table, one would not believe that fittings from an automobile, sewing machine,



Work-table Equipped with Wood- and Metal-working Tools

clothes wringer, guns, etc., were used in making up the tool equipment. The table is mounted on ball-bearing which were taken from an old truck. Although the table, with the tool equipment, weighs over 500 pounds and is less than 3 feet square, it can be easily moved around the room with one hand. As the table is built on three legs, it will rest solidly on an uneven floor with practically no vibration. One leg is of the caster type, which greatly facilitates moving the table in any desired direction. If desired, the caster leg can be clamped positively in place, to prevent the table from being easily moved.

Features that Make Operation Convenient

As the work-table is portable, the operator can bring any side into the most convenient position; the table can also be pushed back into a corner to give room for other work. A receptacle for sawdust is provided, and there are drawers for tools, fixtures, and supplies. The switch that controls the motor is easily reached from all sides of the table. The top of the table is adjustable, and can be raised to an upright position, if desired.

The motor is located near the floor, and is provided with a safety clutch to take care of over-

loads. This clutch is similar to the type used in an automobile transmission unit. The drive shaft, with the drive pulley and the motor sub-base, can be removed as a unit by loosening one nut.

The circular saw and mandrel were purchased, and the usual feed guides and stops for this saw were made from rail angle-iron from an old iron bed. Provisions were also made for miter, tenon, and dado work. An automobile camshaft, with the cams left on, was used for the buzz planer shaft. This shaft was equipped with a 3- by 3 1/2-inch spiral tooth cutter having 15 teeth. The cutter, which was an obsolete gun tool, happened to fit the timing gear end of the automobile camshaft. It is driven at a speed of 3240 revolutions per minute, power being transmitted from the motor to the homemade pulley mounted on the camshaft. The cutter is so located that the maximum amount of projection above the surface of the table is 1/16 inch. The depth of the cut is regulated by a handwheel, which raises or lowers the table, as required.

Wide Range of Lathe Equipment

The lathe bed and tailstock were purchased ready made. Four spindle speeds are obtainable, ranging from 208 to 2030 revolutions per minute. The bed of the lathe consists of a wooden plank, 1 1/2 by 8 inches, which is grooved for steel ways. A drop-leaf is hinged to the edge of the main plank bed, which can be dropped down when not in use. Extension of the lathe bed is obtained by dividing it near the tailstock end. The part on which the tailstock rests is supported on angle-iron ways, which slide in the edge of the bed, so that when anything longer than 2 feet is to be turned, the table can be drawn out a distance of 30 inches. A compound tool-rest is provided for boring, facing, and turning work up to 6 inches in diameter. This rest is made up from angle-iron, turnbuckles, couplings, etc.

A double-end emery wheel spindle and bracket is lined up with the motor shaft, and an automobile fan bracket and pulley is bolted to the under side of the top frame in an inverted position. By cutting the blades off the fan, and using the fan hub for a driver and the fan pulley for the driving head, this assembly is made to serve as a jack-shaft for driving the emery wheel at the required speed of 3300 revolutions per minute. The fan hub, which is mounted on ball bearings, is of the eccentric adjustment type, and therefore permits the tension of the belt to be easily adjusted. The other end of the emery wheel spindle is equipped with a 3-inch emery wheel for use in grinding the planer cutter, an operation for which a suitable fixture is provided. The emery wheel and the bracket can be folded down below the table when not in use.

The heaviest or 10-inch jig saw blade is assembled in a frame similar to that of a hand hacksaw. This frame is made from 1/2-inch pipe fittings, and can be locked in an upright position or swung down under the table when not in use. The saw frame is driven up and down in a tube by means of a cam made from a rear wheel brake-drum of a Ford car. This cam is set off center in an annular ball bearing, so that it drives the saw frame. The brake-drum is balanced and acts as a pulley, which runs at speeds down to 260 revolutions per minute.

Scroll Saw Made from Sewing Machine Parts

A 6-inch scroll saw is made from an old sewing machine head purchased for 50 cents. All parts were removed except the needle bar and the handwheel. This is located on a separate table, and when in use, the grooved handwheel is made to line up with the motor shaft. A 5/16-inch coil spring belt, which always remains tight, is used to turn the handwheel. The arm and the needle bar are in an inverted position under the table, with one end of the saw attached to the end of the needle bar. The other end passes up through the table and is attached to the end of another arm about 20 inches long, which was made from a bicycle frame tube. This tube was tapered down, so that the end of the saw could be attached to it.

The back end of the arm which supports the upper end of the saw blade, is hinged in a bracket supported by the valve spring of a Ford engine. This places a tension on the saw and keeps it sufficiently taut. The bracket is clamped down to the main table by a 1/2-inch wing-screw. A throat plate fitted with a small roll located flush with the top of the table serves to support the back of the saw. The saws used in this frame are of the type purchased in the Five and Ten Cent Stores. The saw table swings down and under the main top of the table when not in use. The convenience of a compact work-table equipped as described will be appreciated by anyone mechanically inclined.

* * *

ARC-WELDING BATTERED RAIL ENDS

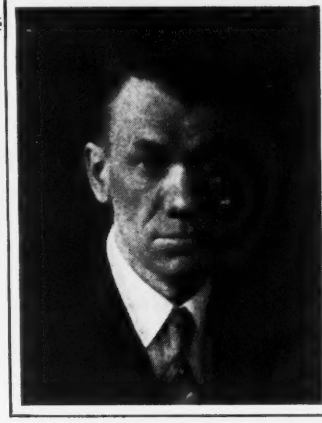
The common practice of reclaiming rails that have battered ends involves not only the removal of the rail from its position in the track and its shipment to some point on the system where it can be cropped, but also holding the shortened rail in stock until some opportunity arises for using it in trackage of minor importance, such as branch lines or sidings.

The *General Electric Review* mentions a method that does not require the rail to be removed and that has been used for several years by the Southern Pacific Railway Co. This method at first consisted of truing up the battered ends with metal deposited by the oxy-acetylene welding process. Recent experience has demonstrated, says the *Review*, that this work can be done even faster and at a lower cost by the electric arc welding process. The equipment required consists of a gas-engine-driven set capable of making a satisfactory weld with a 3/16-inch high-carbon steel electrode at a distance of 500 feet from the generator. The matter of distance is an important requirement, since much loss of time and inconvenience would be occasioned if it were necessary to move the set frequently.

As a result of tests with arc-welding outfits, the Southern Pacific Railway Co. has recently placed two complete gas engine-driven arc-welding sets in service. These sets are mounted on a truck equipped with wheels for rolling on the railroad tracks. Small cross wheels are provided on the truck for convenience in removing the equipment from the track. Besides being used for battered rail ends, these arc-welding sets are also employed for building up worn crossings and frogs.

Backlash and Other Gearing Problems

By W. H. HIMES, Mechanical Engineer, Westinghouse Electric & Mfg. Co., East Pittsburg, Pa.



W. H. HIMES was born in Buchanan, Mich. He graduated from the University of Michigan with the degree of Bachelor of Science in mechanical engineering in 1903. He was first employed by the Wabash Railway on maintenance engineering work, and in 1905 entered the employ of the Seager Engine Works as draftsman. Later he was engaged in erection engineering and sales work for this company. From 1910 to 1915 he operated his own machine shop and then entered the employ of the Federal Motor Truck Co. as chief inspector. After three years in this capacity, he went to the Bessemer Motor Truck Co. as chief engineer. In 1920 he became associated with the Westinghouse Electric & Mfg. Co. as mechanical engineer in the motor engineering department. In 1925 he was appointed assistant to the chief mechanical engineer. His inventive mind has been responsible for the design of many equipment improvements at the Westinghouse Electric & Mfg. Co.'s plant.

ONE of the common fallacies regarding gearing is the belief that backlash is undesirable and that it must be reduced to a minimum for quietness. For general power transmission purposes, backlash would have to be greatly exaggerated to be associated with bad results, and then it would only be associated with the real cause of trouble. Ample backlash is better than not enough. When gears run "idle," the teeth frequently rebound from one face to the other. This also happens when the load is intermittent. Under such conditions the greater the backlash, the greater the noise; but under normal conditions of continuous load, the forward faces of the driving teeth will be pressing constantly against the rearward faces of the driven teeth, so that the actual amount of backlash cannot affect the performance.

It is not the intention of this article to discuss any phase of gear theory, but at this point it seems pertinent to mention the fact, well known to engineers and most mechanics, that involute gears run satisfactorily at any center-to-center distance which is not so tight as to cause binding on the one hand, nor so loose as to permit one tooth to become disengaged before the following tooth picks it up, on the other. Of course, the backlash is increased as the gears are separated. The chief objection to the loose condition is that only a slight amount of wear will begin to break down the continuity of action. General practice is to provide not less than 1.4 pitches of contact between the teeth of mating wheels. For instance, street car pinions are often continued in service after the teeth are worn to a knife-edge. In such instances, the backlash is obviously excessive, but the wear has tended toward even tooth spacing, and this worn pinion will probably be quieter than a new one, with minimum backlash, when it is first installed to replace it.

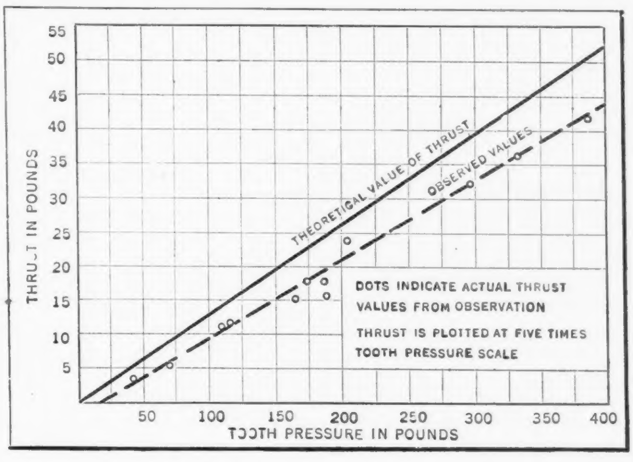


Diagram of Tooth Pressure and Thrust in Helical Gears

Difficulties in Gearing Installations

There are three errors that are present to a slight extent in all gearing installations: (1) Eccentricity in mounting the gear on the shaft. (2) Errors of pitch from tooth to tooth. (3) Errors of individual tooth contour.

It is mostly the eccentricity that makes it necessary to provide some backlash. A frequent error on the part of the mechanic is to adjust the center distance so as nearly to eliminate backlash. Often this is done by slipping a piece of paper between the flanks of the mating teeth and moving one of the gears toward the other until the paper is pinched in place. It is then rolled out, and the gears secured in this position. This method ignores eccentricity; but neither gear is ever perfectly concentric. If the mechanic with his paper happens to find the high spots of both gears, he is lucky. Otherwise, the combined eccentricities of the two gears may readily exceed the backlash provided for by the piece of paper, and when these high spots come together, there is "less than no backlash." The result is a disagreeable grinding sound when the gears are running, and a useless forcing of the gear shafts against their bearings. This "negative" backlash must be absorbed by the springing of the shafts and bearings.

How to Obtain the Best Conditions in Mounting

Generally, the gears can be rotated after the tentative set-up has been made, and if the gears are "bottoming" or binding, the noise or resistance to turning will locate the place, and the obvious relief measures should be taken, making the backlash barely perceptible at the high spots and allowing the loose places to come as they will. Obviously, the precision with which the gears are cut will determine the fineness of the permissible backlash.

In the event that the gearing to be adjusted cannot be separated from its load, correct clearance of the teeth may be secured by bluing or chalking both flanks of the teeth of the larger gear and rolling somewhat more than one rev-

olution of the marked gear in one direction only. If there is proper clearance or backlash, only the engaging flanks (those on the pressure side) will show contact, but if the teeth are wedging, the opposite flanks will also show contact and the centers must be spread accordingly. About a single revolution is sufficient in the case of a gear and pinion, but if the gears are of nearly the same diameter, a hunting condition is encountered, which may make several revolutions necessary to bring the two high spots together.

Materials for Pairs of Gears

Repair men are frequently confronted with the question of suitable materials. One frequently has to replace a cast-iron gear, for instance, with the most suitable material at hand. He has no pattern —what available material will work satisfactorily? The following materials work well together:

Soft steel with cast iron; hard steel with cast iron; hard steel with hard steel; hard steel with soft steel; any steel with brass or bronze; cast iron with brass or bronze; fiber, micarta, rawhide with any metal.

Avoid soft steel on soft steel or brass on brass, except for very light loads. Also avoid working two gears together both of which are of fibrous material. An apparent exception in the case of soft steel on soft steel is found in high-speed turbo gears. These are of fairly high-carbon steel and run with moderate tooth pressures, and they are protected by an oil spray on the teeth at all times. In spite of this, pitting frequently occurs, and in general, the combination of two soft steel gears is dangerous.

Helical Gears for Motor Drives

The matter of helical gearing for motor drives is one that frequently arises. A spur gear is noisy —why not substitute helical gears? What thrust is developed by helical gears? The writer made a test on a helical gear set, on a motor drive, to determine this point.

The ratio between peripheral tooth pressure and resultant thrust was determined by measurements taken while the gearing was in operation under various loads. The tangential tooth pressure was determined in the usual way from observed revolutions per minute and wattage. Corrections of horsepower were made from an efficiency chart of the motor. The thrust was measured by applying a graduated spring balance against the end of the motor shaft with sufficient pressure to balance the thrust and move the shaft away from the face of the bearing. As there was over 1/4 inch end play between the bearings, it was easy to tell when the thrust surfaces were separated. This device was not made up for this test, but was borrowed for the occasion from the motor test department, several of these instruments being in regular use for detecting irregular magnetic action in motors.

This test brought out conclusively that the thrust developed by helical gearing was practically proportional to the tangent of the helical angle. The accompanying illustration shows the results of this test. Observed thrust pressures are plotted as ordinates, while the horizontal distance from the origin is in each case proportional to the corresponding peripheral tooth pressure. Owing to the fact that the helical angle of the gear tested was very low (7 1/2 degrees), the ordinates are plotted to an exaggerated scale. The sloping line shows the tooth angle exaggerated to the same degree. The closeness with which these readings approximate the theoretical figures shows clearly that the designer must provide for practically the full amount of thrust.

The drive tested was between a 15-horsepower motor and a large lathe. The motor was more powerful than needed. When the rated load was placed on the motor, it quickly became heated at the bearing receiving the thrust. It would have been damaged if the run had continued for half an hour. Yet, owing to the light load imposed by the lathe, the gears have given satisfactory service for six years.

In general, ordinary motors are not provided with sufficient thrust collar area to stand the use of even 7 1/2-degree helical gears at the rated loading, continuously. However, where the loading is intermittent, as with crane and other hoisting motors, helical gears of moderate angle may be used without dangerous heating, although the wear on the bearing faces will be faster than with spur gearing.

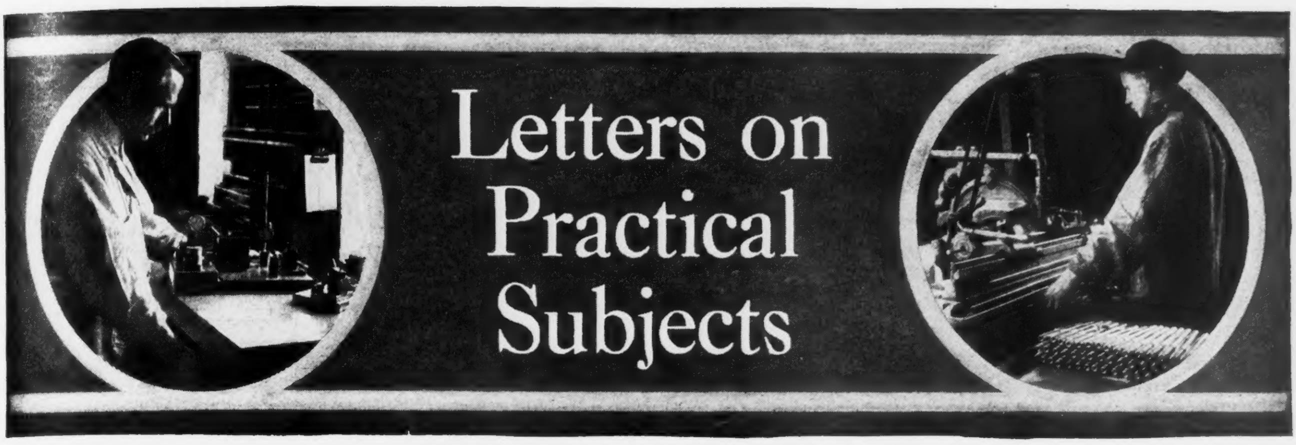
* * *

THE "CLOUDBURST" SUPER-HARDENING AND HARDNESS TESTING PROCESS

A paper presented by Edward G. Herbert before the September meeting of the Iron and Steel Institute of Great Britain, dealt with the super-hardening and hardness testing of parts by means of the "Cloudburst" process. In this process, a part made of hard steel is immersed in balls which move about at a high velocity, striking each other and the part in rapid succession. This produces a thin super-hardened layer on the part analogous to that obtained on automobile gears and other parts as they become worn in service. It has been found that after the layer has been started, the velocity of the balls can be increased and this will increase the hardness and thickness of the layer, the layer resisting indentation. The super-hardened layer gradually decreases in hardness throughout its thickness, and as there is no abrupt change in hardness, the layer has no tendency to scale.

The degree of hardness that can thus be produced depends upon the super-hardening capacity of the steel, which is easily measured by means of the "Pendulum" hardness tester manufactured by Edward G. Herbert, Ltd., Levenshulme, Manchester, England, which was described in the June, 1923, and October, 1924, numbers of MACHINERY. The ball velocity required to produce the hardness is determined by experience.

The initial ball velocity is so adjusted to the hardness of the work that it is just enough not to indent the surface. It follows, than, that if any part of the work is soft, its surface will be indented and roughened. This has resulted in a new process, by means of which large quantities of hardened articles can be tested for hardness, all at once and all over, without marking them except on soft spots. An existing "Cloudburst" testing machine makes 200,000 hardness tests per minute.



EXAMPLES OF V-DIE BENDING

Some interesting examples of various types of bends that may be made in a V-die are shown in the accompanying illustration. The construction of the die and punch used is such that it will permit a large variety of right-angle bends to be made on angular strips of sheet metal. The die shown in the six cross-sectional views is about 2 feet long. A plan view of the die is shown at *G*, in the lower right-hand corner of the illustration. In each case, the punch *H*, which is secured to the ram of the press, is caused to move up and down in the usual manner. The member *I* is held in the die-bed of the bolster plate of the press. Two operations performed in this die are indicated in view *A*.

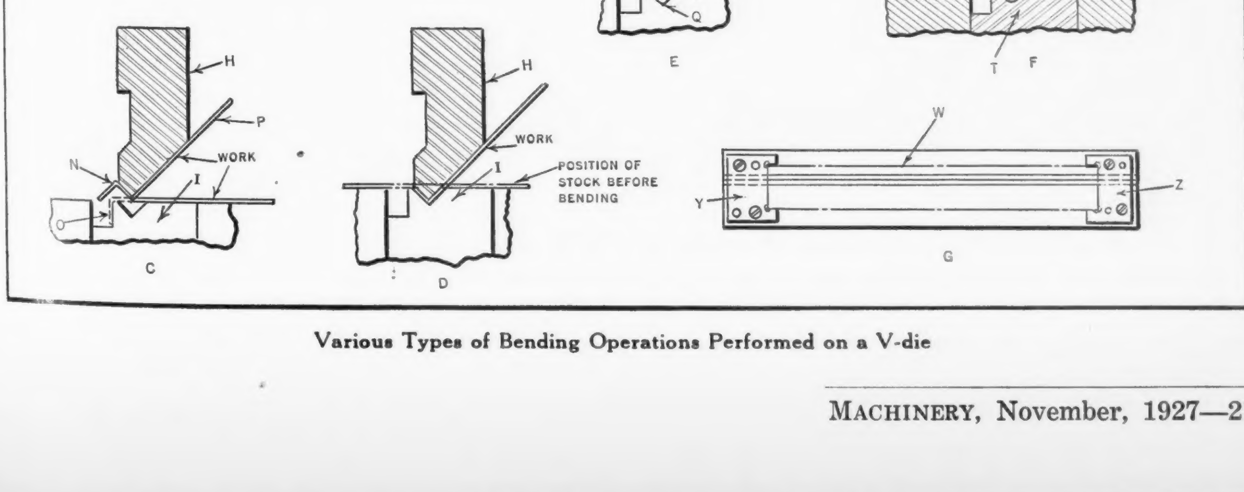
The first operation consists of laying a piece of flat strip stock on top of the die *I*, where it is located by a suitable gage secured to the die. After the strip is in place, the punch descends and forms a right-angle bend, leaving one side straight, as indicated by the dotted lines. After all the parts are bent in this manner, the locating gages are removed from the top of the die and replaced by other gages that hold the work in the proper position while the next operation is performed. The latter operation consists of bending the piece to the U-shape indicated by the full lines. It will be noted that the punch is cut away at *X* to provide a clearance space for the work.

The type of gage generally used for locating the work on the die is indicated diagrammatically in the plan view at *G*. A strip of stock is indicated at *W*. The stock is simply dropped between the locating plates or gages *Y* and *Z*, which are held in place by screws. These locating plates are removable, and are cut from flat stock about 1/8 inch thick. They are also cut at the end to suit the particular strip to be bent.

In view *B* is shown a bending job which differs from the one described in that one side of the finished work is longer than the other. The blank on which the bends are made is first laid on top of the die and the short end bent up at *J*, at which time the other side or end remains in the position shown by the dotted lines at *K*, the short side stopping at point *L*.

The work is next placed on the die, where it is positioned by locating plates *Y* and *Z* (view *G*) which have narrow gage openings of the size required to locate the work properly. These plates locate the work for making the bend at *M* (view *B*), the long side lying flat on top of the die. The press ram again descends and the final bend is made at *M*, causing the work to assume the shape indicated by the full lines.

The views at *C* and *D* show diagrammatically the various positions assumed by the piece of work while it is being bent to the shape shown at *N*. In



Various Types of Bending Operations Performed on a V-die

the first operation, as indicated at *D*, the work is so bent that it has one short side and one long side. The work is next turned over so that the short side lies against the die, as indicated by the dotted lines at *O* in view *C*. The punch then descends and the stock is bent so that the longer side lies against the die, as at *P*. These two bending operations produce the two right-angle bends indicated at *N*.

The views at *E* and *F* show how four operations are performed on pieces of flat plate, 2 feet in length. The first two operations are performed as indicated in view *E*, while the last two operations are accomplished in the manner indicated in view *F*. A flat plate is laid on top of the die, where it is located by the gages in the manner previously described. The press ram then descends and makes a right-angle bend at *Q*, after which the plate is turned end for end and another right-angle bend made as shown at *R*. This leaves the work with a long base section *S* and two short sides.

The work is next set on top of the same die where it is located by another set of gages. A right-angle bend is then made at *T*, following which the work is again turned end for end and a right-angle bend made at *U*, thus completing the bending operations on the part. These operations give the part the rectangular shape indicated, with the top side open across the center for a distance of about two-thirds the length of the part.

The examples of bending illustrated and described in this article show what can be accomplished in bending sheet or plate metal on a die equipped with suitable locating plates or gages.

H. M.

SCREEN COVER WITH CAST-METAL RIM

When made in small quantities, enclosing covers or screens of the ventilating type are very expensive, owing to the amount of hand work necessary to produce a neat and serviceable job. To avoid this undue expense, the cover shown in Fig. 1 was devised. This consists of a disk of metal gauze *A*, around which is cast a framework *B* of metal.

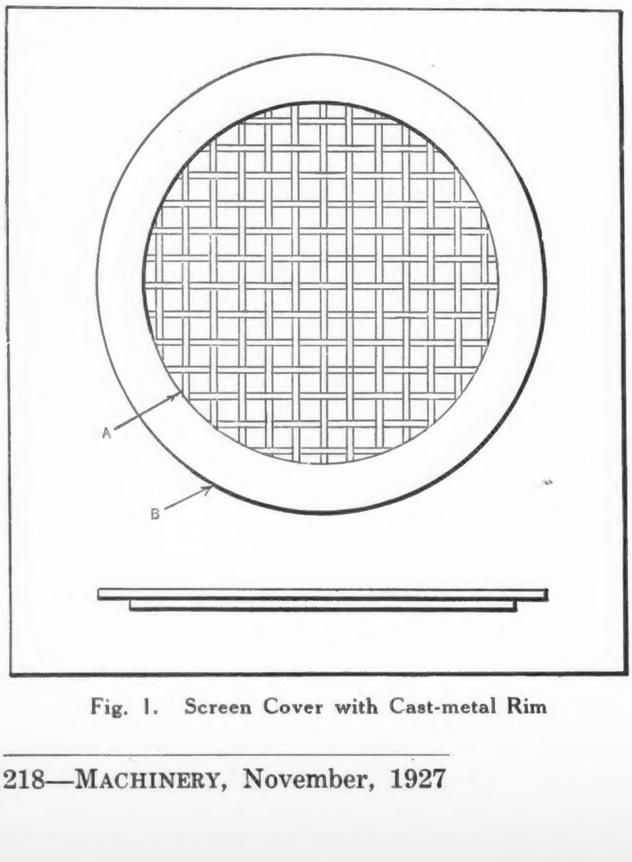


Fig. 1. Screen Cover with Cast-metal Rim

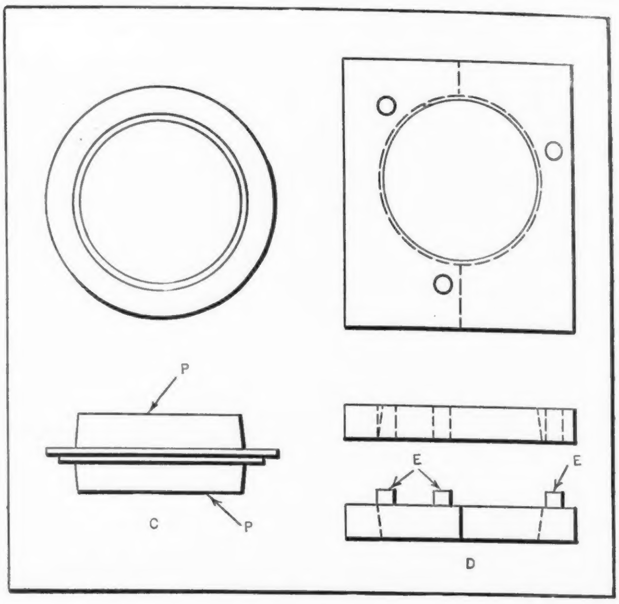


Fig. 2. Pattern and Core-box Used in Producing Cover Shown in Fig. 1

At *C*, Fig. 2, is shown the pattern for casting the rim *B*, Fig. 1. This pattern has two core-prints *P*. The core-box shown at *D* is split to facilitate removing the core. In ramming up the core, the bottom half is made first, after which the disk of metal gauze is inserted, being located by the spacing pins *E*. The top portion of the box is then put on and the gauze rammed up with core sand.

Upon removal from the box, the core is touched up on the parting joint, if there are any spaces in the mesh of the metal gauze which are not filled in with sand. The molding or casting is carried out in the usual manner. After being removed from the mold, the metal screen or gauze has a tendency to bulge, but this fullness is easily flattened out between two blocks of wood. While the cover shown in Fig. 1 is of the circular design, covers of any shape desired can be produced in the same manner.

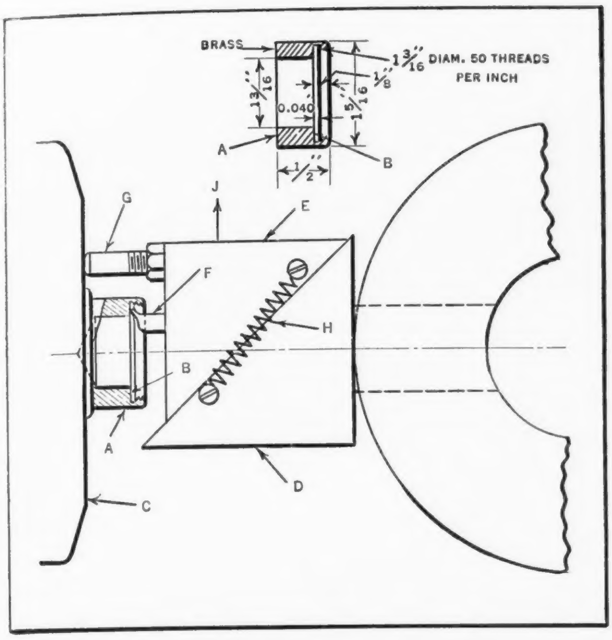
Willimantic, Conn. H. A. FREEMAN

SPECIAL FINISH-FACING TOOL FOR AUTOMATIC

The writer recently had occasion to set up an automatic screw machine for the production of the piece shown at *A* in the accompanying illustration. The surface machined at *B* was required to be japanned, and any minute undulations on this surface, although invisible on the unfinished piece, showed up on the bright surfaced japan.

It was, therefore, quite a problem to obtain the desired finish on this surface. As a glossy finish was also undesirable, it became evident that a diamond-pointed tool, having a fine feed and moving in an extremely true plane was the only means by which the required finish could be obtained.

When an attempt was made to machine this surface with ordinary tools of the swinging type, it was found impossible to eliminate the slight wavy appearance resulting from failure to keep the point of the tool moving in a perfectly true plane at right angles with the axis of the work. All the methods usually employed to make the tool run true were tried without success. The turret was made to



Accurate Facing Tool for Automatic

dwell and press tight against a stop, and the bearing slides were tightened, but still satisfactory results were not obtained. After much experimenting, the tool-holder here illustrated was developed.

The design of this holder is based on the principle that the cross-feeding movement must be controlled or guided by the member in which the work is held, in order to eliminate the effect of the very slight unavoidable vibrations in either the tool-holding member or the work-holding spindle, or both. The difficult problem of making the turret dwell in exactly a fixed position without vibrating was thus avoided in designing the new tool. The inequalities often caused by small irregularities or foreign particles on the cam surface was another difficulty overcome. Still another fault of the swinging type of tool, not found in the tool illustrated, was the necessity for adjusting the parts loosely to prevent the gumming up of the slides by the fine chips which accumulated in the oil. This looseness allowed a slight "shake."

The long bar of stock held in the spindle was usually unbalanced and often bent. This condition caused the spindle to have an irregular endwise movement, owing to the slight play in the bearing. However, this did not affect the accuracy of the new tool, as any vibration on the part of the work, caused a similar vibration in the tool-holder, without causing variations in the position of the tool with respect to the work.

Referring to the illustration, the turret tool has a shank *D*, the front face of which is machined to an angle of 45 degrees. On this face is fitted the slide *E* which carries the turning tool *F*. An adjustable stop *G* serves to keep the tool-block at a uniform distance from the accurately ground face of cap *C*. The end of stop *G* is kept in contact with cap *C* by means of coil springs *H* located on each side of the slide. A roughing cut is taken on the surface *B* with a swinging type of tool before taking the finishing cut.

The operation of finish-turning the face *B* of the work consists of advancing the turret in the usual manner until the stop *G* engages the spindle cap *C*. The feeding movement of the turret is then slowed down to give the correct feed. A further advance of the turret causes part *E* to slide on member *D* and the stop to move transversely in the direction of the arrow *J*, the stop, of course, sliding upon the rotating spindle cap. The cutting part of the tool is thus controlled by the spindle and is not dependent upon cams or cross-slides.

This method proved entirely successful, the finish obtained being readily controlled by the feeding movement and the form of tool used. For instance, a mirror-like finish could be obtained with a round-nose tool or a surface having a silky sheen could be obtained with a diamond-pointed tool, using a fine feed. The spindle speed employed for this facing job was approximately 1216 revolutions per minute.

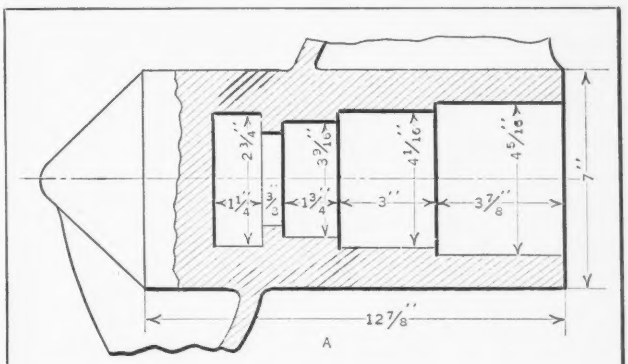
Rochester, N. Y. ERNEST C. ALLEN

MULTIPLE CUTTER BORING TOOL

Recently the writer was confronted with the job of boring some cast-iron extractor worms like the one shown at *A* in the illustration. These worms were 24 inches in diameter, and owing to their peculiar shape, were difficult to hold on a boring mill table. As it was found impractical to bore the holes with three different sizes of boring tools of the ordinary type, the writer had the tool shown at *B* made up for the purpose. This tool consists of a machine-steel bar carrying three high-speed steel cutters held in place by 3/8-inch headless setscrews. The cutters are so located that they form shoulders at the correct positions in the bore.

Using a 6-foot radial drill, strapping the castings to the side of the table, and boring with the tool shown, gave a production rate of 30 minutes per piece. After boring the hole, the end of the hub was faced at the same setting with a 7-inch counterbore having a 4 5/16-inch pilot. It was found that the ordinary Morse taper shank would not give sufficient driving power for the heavy cut, and to overcome this difficulty, a hole was drilled through the shank of the tool and the drilling machine spindle for a 1/2-inch cross-pin.

Portland, Me. H. K. GRIGGS



Casting and Tool Used to Finish the Bore

smoothly and without chatter, though, of course, heavy cuts are not taken with it.

Cleveland, Ohio — AVERY E. GRANVILLE

COOLING STACK FOR SHOP MOTOR

A moderately warm motor can sometimes be cooled without resorting to the use of fans or blowers by employing stack or chimney circulation. With this method of cooling, a sheet-metal hood having openings cut out on all sides close to the floor is placed over the motor. A stack made up of 6-inch galvanized iron pipe connected with the top of the hood extends to the roof.

This method of cooling a motor that was in constant operation proved very satisfactory in the case of one installation. The stack connected to the top of the hood in this particular case was made from 6-inch galvanized duct or heater pipe. The upper end of this stack extended through the roof, which was about 35 feet above the motor. The circulation of air obtained was sufficient to carry away the excess heat and keep the motor running at a safe operating temperature.

Washington, D. C. — G. A. LUERS

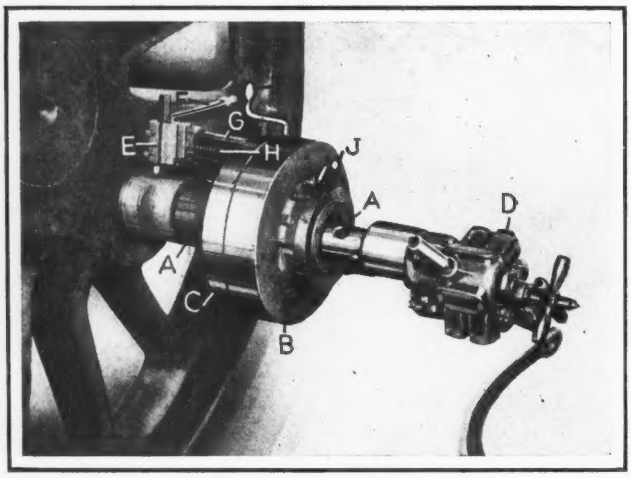


Fig. 1. Air-driven Crankpin Turning Machine

CRANKPIN TURNING MACHINE

Many railroad shops build their own special machines, because it is easier than to get requisitions through for new ones that are on the market. This develops mechanical ingenuity, and often very interesting devices are to be found in a railroad shop. An ever recurring locomotive repair job is the returning of the crankpins on the driving wheels. In one shop, the machine illustrated in Figs. 1 and 2 has been devised especially for performing this operation.

The center bar *A* is screwed fast to the end of the crankpin by means of the regular stud screw. This bar carries the main body *B* of the machine. The part *C* carries the cutter-bar, and is made to revolve by means of a ring gear and a pinion operated by the air motor *D*. The cutting tool is clamped in the cutter-head at *E*, and it is adjusted up or down by means of the wrench *F*, which operates the slide-screw of the cutter-head. The cutter-head is moved along the bar *G* by the feed-screw *H*, operated by the crank *I* or the power feed, which is thrown in by pushing handle *J*. The whole machine is made heavy and strong enough to cut

ECONOMY IN LAYING OUT BLANKING DIES

The laying out of blanking dies and the design of the part to be blanked are very important factors to be considered when trying to effect economy in the shop and, of course, with the keen competition existing today, we are all trying our best to economize. However, the results of our efforts in this direction are not always gratifying. Take, for example, the variable condenser stator plates shown at *E* in the accompanying illustration. When the radio engineers designed the first commercial variable condensers, they made the stator plate *F* half round in shape, apparently because this form could be more readily laid off on sheet metal than the form outlined at *G*, view *D*. The half round form idea was carried along to the toolmaker, the

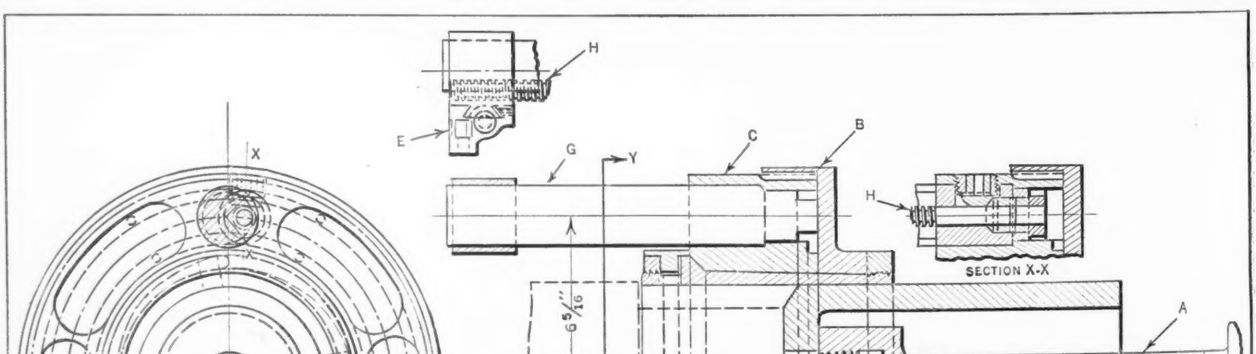


Fig. 2. Sectional Views of Machine Shown in Fig. 1

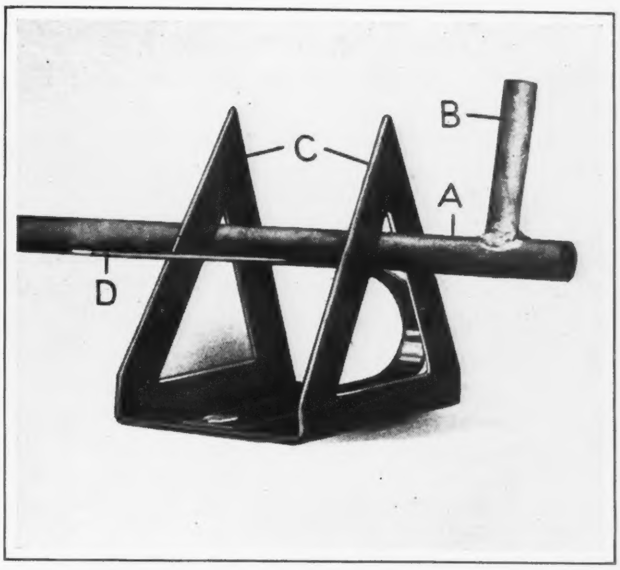
dies were made, and many tons of half round plates were punched out by various manufacturers.

It may be well to mention here that it is essential, electrically, that the stator plate of a condenser cover the rotor plate. The stator plate *F* covers the rotor plate *H*, and the excess metal in the stator plate extending beyond the rotor plate is simply wasted material which serves no useful purpose. The scrap from three different dies is shown at *A*, *B*, and *C* respectively. In these views the outlines marked *S* represent the openings in the die. The scrap stock shown at *A* was fed through the die once, while the scrap stock shown at *B* and *C* was fed through twice.

The lay-outs shown at *A* and *B* are examples of wasteful and economic practice, respectively. The amount of stock consumed per blank with the lay-out shown at *A* was 5.396 square inches, while the amount of stock consumed per blank with the lay-out shown at *B* was 5.004 square inches. The difference is therefore 0.392 square inch per blank. At a production rate of 10,000 blanks per day for 200 days a saving of 784,000 square inches or 5444 square feet was thus effected.

A saving of 5000 square feet of 0.025-inch sheet aluminum is an item worth considering when designing a die. However, this saving is insignificant as compared with the savings made by further considering the material and the form of the product in relation to the die lay-out. The scrap from the stator plate *G* (view *D*) which serves the same purpose as the half round plate *F* (view *E*) is shown at *C*. The advantage of a blank of this shape with respect to economy in the amount of stock required is clearly evident when the lay-out at *C* is compared with that at *B*. With the lay-out shown at *C*, one stator plate is produced for each 3.531 square inches of material, or about two-thirds the amount of stock needed for the form of plate shown at *F* (view *E*). This means that the same number of plates can be produced from ten tons of material when using the form of stator shown at *G* (view *D*) as from fifteen tons, when using the form shown at *F* (view *E*).

ATOL MAKER



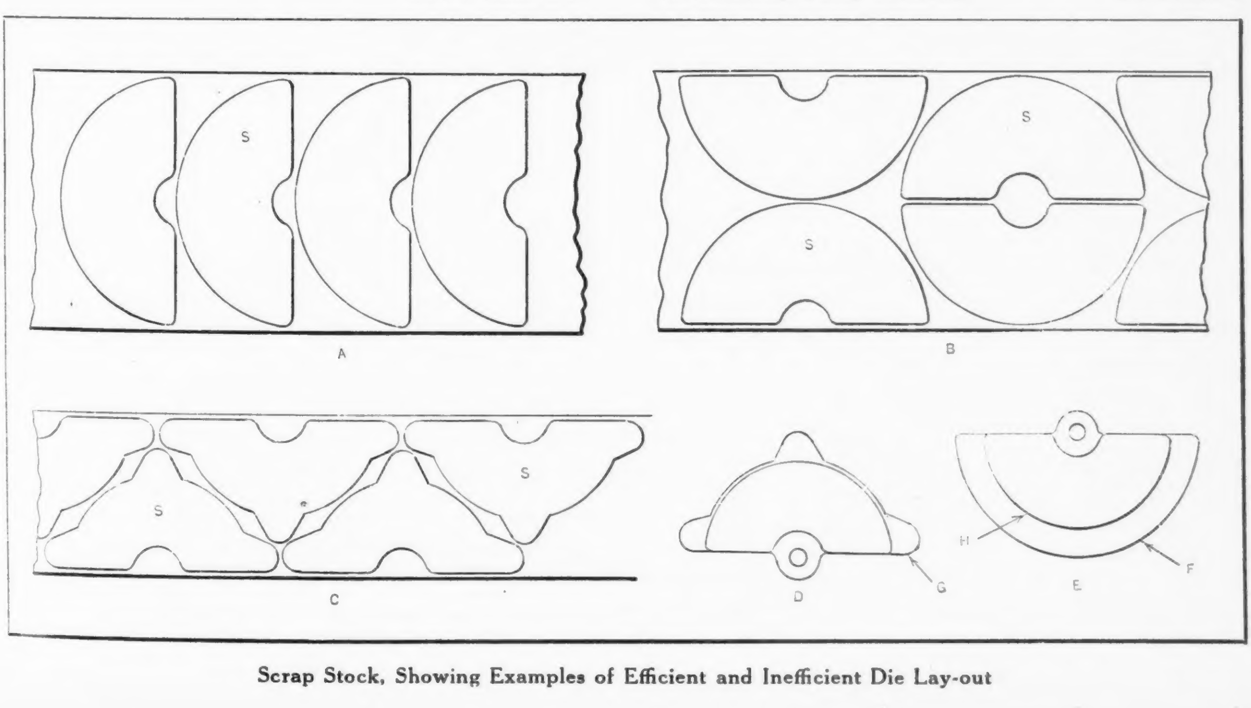
Clamp for Holding Tubing while Brazing

SPRING BENCH CLAMP FOR HOLDING TUBING

The accompanying illustration shows a practical device for holding a length of tubing *A* while attaching another piece *B* by brazing. The requirements for work of this kind are that the fixture hold the tubing firmly without damage and yet permit it to be easily and quickly moved to any desired position as the work progresses.

The fixture is made in two pieces, namely, the double V-body *C* and the bent-over flat spring *D*. The body is made of sheet steel cut out with two V-shaped openings in the ends. After the openings are cut out, the ends are bent up as shown. The flat spring *D* is then riveted to the body, and the assembled clamp is ready to be secured to the bench with wood-screws. To operate the fixture, it is simply necessary to press down spring *D* and push the work through the V-openings above the spring; then when the spring is released, it will exert sufficient pressure to hold the work securely in place during the brazing operation.

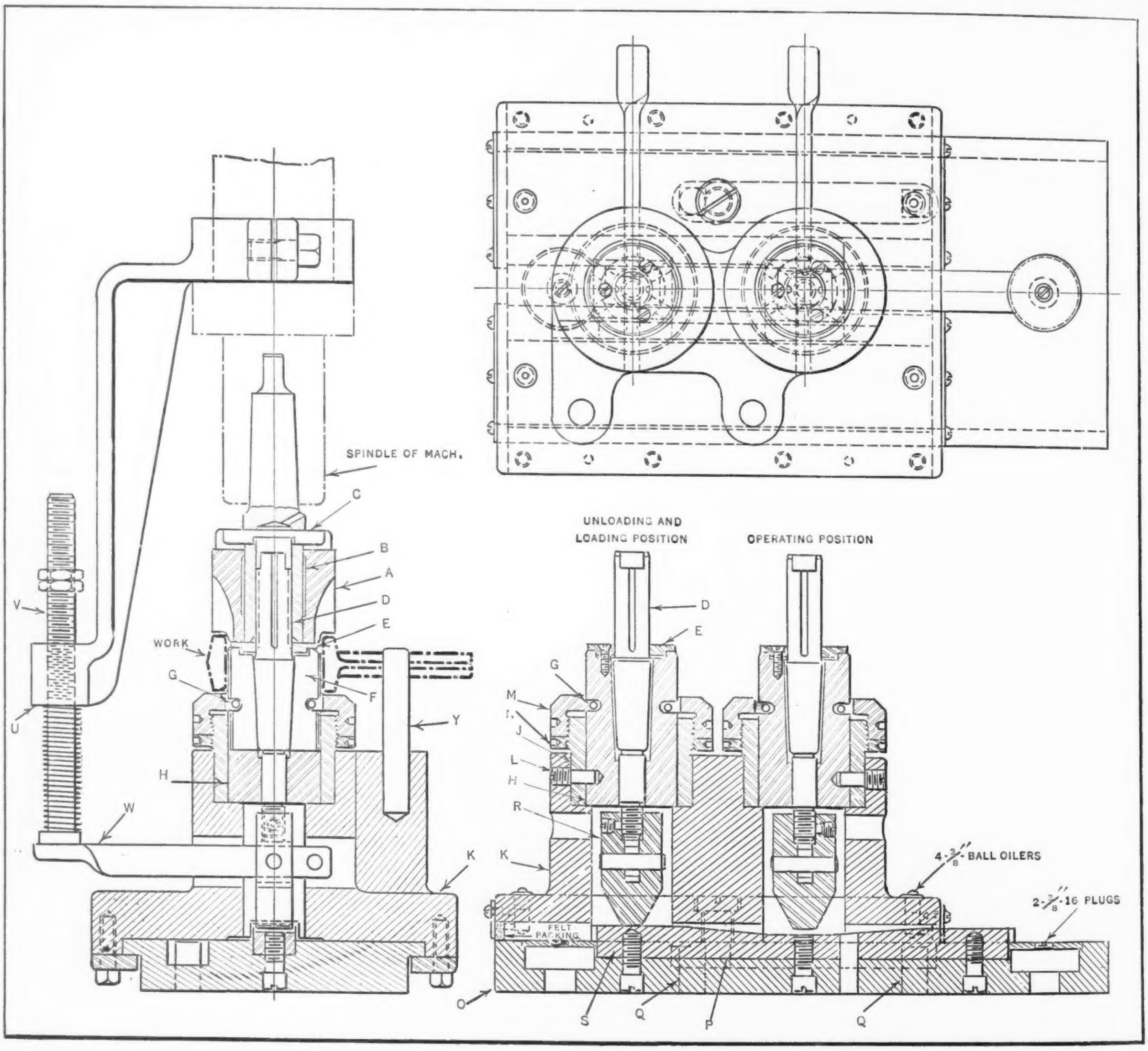
Hamilton, Ont., Canada H. MOORE



Scrap Stock, Showing Examples of Efficient and Inefficient Die Lay-out

FACING AND RADIUS-FINISHING FIXTURE FOR CONNECTING-ROD

The fixture shown in the accompanying illustration was designed to obtain a high degree of accuracy in facing connecting-rods square and to width. It has been in constant use for the last six months on intensive production schedules and has proved satisfactory in every way. The principle of operation can easily be understood from an inspection of the illustration, and the following description will give a clear idea of the details. As the two work-holding arbors are alike, only the one at the left will be described.



Drilling Machine Fixture for Facing and Radius-finishing Connecting-rod

The cutter *A* is a solid piece, fluted as shown, and held by the shank *B*, which has a slight taper. The cutter is driven by pin *C*. A ground hole on shank *B* fits the pilot member *D*. The feeding movement of the cutter is stopped by a hardened plate *E*, which insures uniformity in the machine work. The pilot *D* bears against the inserted jaws *F* of the work-holding arbor *H*. An upward movement of pilot *D* causes the jaws *F* of the work-holding arbor to contract, and a downward movement causes them to expand. A spring *G* holds jaws *F* against the tapered surface on pilot *D*.

Bushing *J* is pressed into the casting *K*, and is held in place and located by screw *L*. The members *M* and *N* form an adjustable stop on which the connecting-rod rests. The fixture is made in two parts, the upper portion sliding back and forth on the base *O*. Screw *P* in the upper portion and the pins *Q* in the base serve as locating stops for the working and unloading positions of the fixture, respectively. When the fixture is in the position shown in the side view, the member *R* rides on the cam *S*. Part *R*, being secured to the end of pilot *D*, raises the latter member and thus allows the inserted jaws to recede so that the finished rod can be removed and another one substituted.

When the machining operation is to be performed, the fixture is moved forward so that the member *R* is over the depression in cam *S*. As the cutter is brought down into place, piloted on *D*, the arm *U* and plunger *V*, which are fastened to the spindle of the machine, also move downward. These members strike the lever *W* and keep it under a spring tension. When lever *W* is forced down by plunger *V*, the tapered portion of pilot *D* is forced against the jaws *F*, causing them to expand and hold the work securely in place. The base *O* is secured to the table of a single-spindle drilling machine. The pin *Y* serves as a stop to prevent

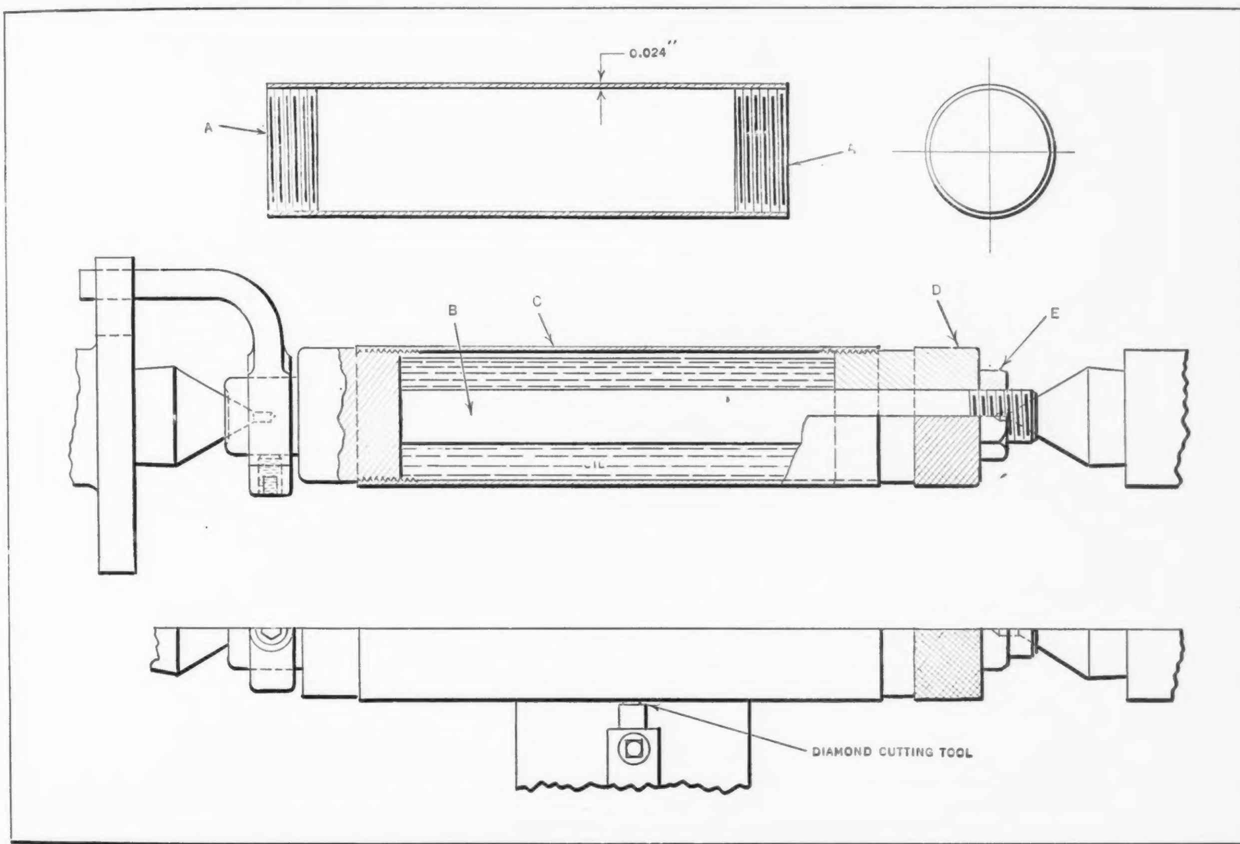
the connecting-rod from turning during the facing operation.

Kenosha, Wis. CHARLES F. STEIN

TURNING THIN BRASS TUBING

The telescoping tubes of a microscope must be held to very close limits on the outside diameter and must also be polished to a very smooth finish in order to permit a free and easy movement of one tube within the other. Considerable difficulty was at first experienced in meeting these requirements.

The tubes are threaded on the inside at each end and are turned on the outside while mounted on a mandrel held between lathe centers. The threads are, of course, required to be true with the outside surface. After the tubes were turned with a round-nosed tool and buffed and polished, they were found to be out of round. The polished surfaces had a wavy appearance and the diameter of the tubes varied, at different points, from 0.003 to 0.005 inch.



Method of Holding and Turning Thin Brass Tubing

The new method of holding the tubes described in this article successfully eliminated the principal difficulties previously experienced in obtaining the required polish and accuracy. The tubes, after being threaded on each end at *A*, are placed on a mandrel such as shown at *B*. This mandrel is centered on both ends so that it can be mounted on the centers of an engine lathe. The tube *C* to be turned is first screwed on the mandrel at the head end, after which the tube is filled with a medium grade of machine oil. The nut *D* is then screwed on, being followed by the lock-nut *E*.

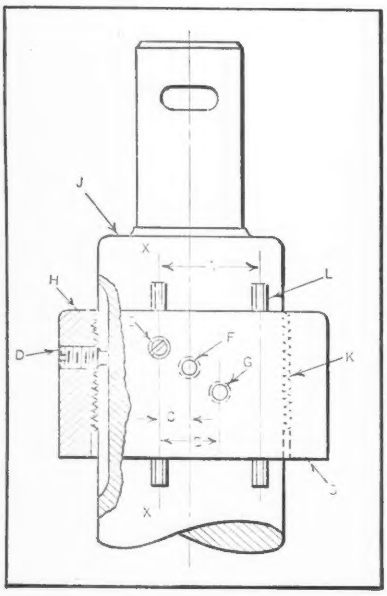
The internal threads in the tube are thus centered or aligned with the axis of the tubing and the oil is confined within the body of the tube. Next the mandrel is mounted on the lathe centers, and the tube turned to the desired diameter with a diamond turning tool mounted in a holder such as shown in the lower view of the illustration. Two different lathes are used for the turning operations. One lathe is used for taking the roughing cut, leaving about 0.010 inch on a side for the finish-turning operation, which is performed on the other lathe.

A minor difficulty encountered in turning the tubes resulted from the vibration produced whenever a workman walked across the floor within 15 feet of the lathe. The vibrations were recorded on the turned surface of the tube by the diamond cutter in the form of a ridge or wave. In order to overcome this, the four legs of the lathe were set on solid rubber cushions about 5 inches square. Each cushion had a hole through its center for the bolt which fastened the lathe leg to the floor.

Rochester, N. Y. BERNARD J. WOLFE

ADJUSTABLE STOP FOR FACING TOOL

A stop that can be adjusted within close limits and yet is capable of resisting considerable pressure without danger of changing the setting is shown in the illustration. The adjustable collar *H* controls the depth of cut of the forming, seating, or facing tool secured to the lower end of the bar. The bar *J* is threaded and grooved as indicated in the illustration. There are twenty-five threads per inch at *K*, and five evenly spaced grooves *L* in the bar *J*. The point of screw *D*, indicated in the broken section, should be considered as being located on line *X–X*, so that the threaded holes *F*,



Adjustable Stop for Facing Tool

G, and *E* in the collar *H* will appear in their proper relation to each other.

Holes *E*, *F*, and *G* are drilled and tapped on different planes, in order to avoid interference. This method of positioning the tapped holes also facilitates indicating the amount of change in depth of cut obtained by transferring the screw *D* from one hole to another. The position of the stop face *S* on the bar may be adjusted by turning back the screw *D* or *E* until the point clears the slot in the bar. The collar, then being free to turn on the bar, may be adjusted until the point of the screw can again be inserted in the next groove or whatever groove will give the required setting.

Turning collar *H* an amount equal to dimension *A*, or 1/5 of a turn, changes the position of face *S* 1/5 of 1/25 or 1/125 of 1 inch. The values of *A*, *B*, and *C* being equal to 1/5, 1/10, and 1/20 of a turn, respectively, it follows that, by transferring the set-screw from *E* to *G*, a change in the setting equivalent to 1/250 inch can be obtained, and by transferring the set-screw from *E* to *F* a change equivalent to 1/500 of 1 inch, or 0.002 inch, can be obtained.

With the combination of slots and screw holes available, almost any desired setting can be obtained; that is, the number of threads per inch on the stop-collar, the positions of the screw holes, and the evenly spaced grooves provide a sufficient number of combinations to take care of any adjustment that would be required under ordinary conditions.

Cleveland Heights, Ohio — JAMES MCINTOSH

SPECIAL DON'TS FOR DRAFTING-ROOM MANUAL

There are certain conditions peculiar to every industry that place limits on the designer's work. Time is often lost and confusion caused by new draftsmen who are not thoroughly familiar with the particular requirements of the industry. Often the specification of sizes or processes that were acceptable practice in one industry are not permissible in another. In fact, if not caught in time, such errors may lead to serious trouble.

A certain airplane manufacturer meets this situation successfully by placing in the front of his drafting-room manual, which is given to all new draftsmen to read on their first assignment, a tabulated series of "Prohibited Uses." To illustrate this simple "trouble insurance," a few examples are given in the following:

Don't use steel tubing less than 20 B. W. G. thick on stressed parts.

Don't use sheet steel less than 18 B. W. G. in thickness on stressed parts.

Don't use aluminum or aluminum alloy in contact with brass or copper, except on the gasoline system.

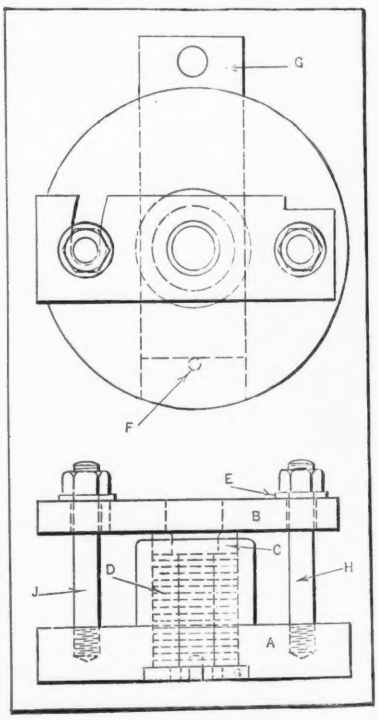
Don't use steel machine screws on airplane parts —always use brass.

Vineland, N. J. — N. RICHARD

DEVICE FOR HOLDING WASHERS WHILE ENLARGING THE HOLES

One of the jobs recently handled in the shop where the writer is employed, required 1000 plain cut washers, 1 3/4 inches outside diameter with a 57/64-inch hole. The standard 5/8-inch cut washer is 1 3/4 inches outside diameter and would suit if the hole were enlarged. To enlarge the hole quickly and at low cost, the method here illustrated was employed.

An old cast-iron gear blank *A*, with a hub sufficiently long to contain about fifteen to twenty washers *D*, was bored about 1/32 inch larger than the outside diameter of the 5/8-inch washers. A slot was cut across the large face of the gear blank to admit a 1/4- by 2-inch cold-rolled steel plate *G*. In this plate was drilled a 1-inch diameter hole about 2 inches from one end, and a 1/4-inch pin *F* was so placed as to bring the 1-inch hole concentric with the bore in the gear blank. At the other end of the plate a finger hole was drilled to enable the operator to withdraw the plate from the slot. A drill guide *C*, of tool steel, hardened, was made a slide fit in the hub bore. Studs *H* and *J* and clamp *B* were provided as shown.



Device for Holding Washers while Enlarging the Holes

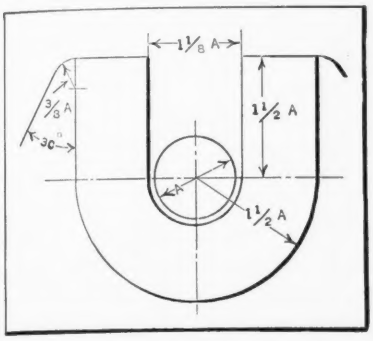
For the operation, base *A* is bolted to the drilling machine table over a 1 3/4-inch clearance hole, slide *G* is pushed in to stop *F*, and the washers are placed in the hub of the gear blank. The drill guide is then put on top, allowing it to enter about 1/4 inch into the bore, and the clamp is swung into place and tightened down. After the drill has passed through all the washers, the clamp is simply released, the drill guide removed, and a pull of the slide unloads the jig completely. The entire operation took about two minutes a loading, and the work was perfectly satisfactory.

Baltimore, Md. — R. H. DAUTERICH

Shop and Drafting-room Kinks

U-LUG PROPORTIONS

For many years the writer has used dimensions for U-lugs proportionate to bolt diameters, as shown in the accompanying illustration. The proportions are so simple and direct that they can be readily remembered. The dimension *A* represents the size of the bolt used. These lugs have been successfully used on all sorts of machinery and tools from time to time. When lugs of these proportions are used, it is unnecessary to look up flat washer sizes or suitable clearance allowances for each bolt used. The proportions automatically determine the length the lug should project from the body of the tool or machine part. This settles a debated point in the minds of many designers.



U-lug Proportions

Kent, Ohio A. W. JANSSON

REMOVING THREADED RING

The threaded ring that retains the glass over the face of a small steam or air gage is sometimes quite difficult to remove. This is particularly true in the


Method of Removing Gage Glass Ring

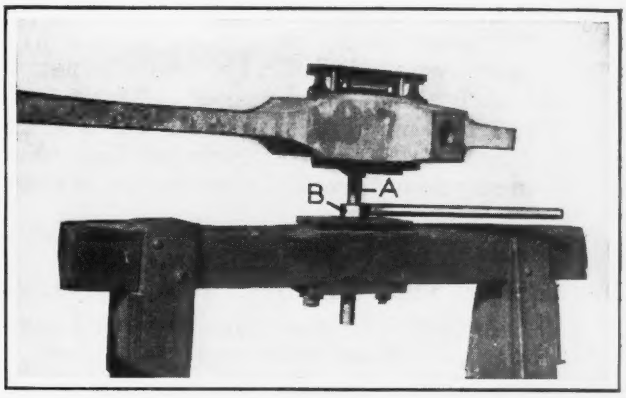
case of a brass ring screwed on an iron case. The full strength of the hands cannot be exerted in unscrewing the ring, because the fingers slip.

To facilitate the removal of a ring under such conditions, the writer cut off a piece about 1 inch long from an old inner tube of an automobile tire and snapped this piece over the ring, as shown in the accompanying illustration. The fingers and palm of the hand do not slip when this rubber grip is used and all the strength can be applied where it will be the most effective in starting the ring. The writer has found this to be a useful kink in removing the rings for resetting the hands of the gage or for replacing broken glasses.

Missouri Valley, Iowa FRANK W. BENTLEY, JR.

LEVELING JACK

A very handy and cheap form of leveling jack for use on wooden horses, etc., is shown in the accompanying illustration. The screw *A* is 1 1/4 inches in diameter and is electrically welded to a



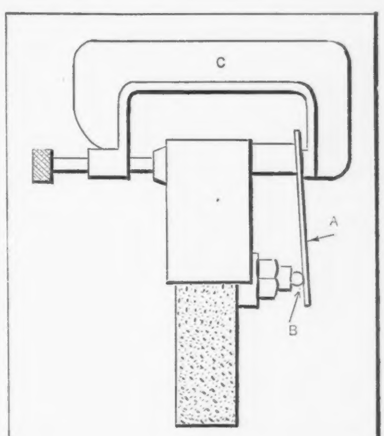
Inexpensive Form of Leveling Jack for Use on Wooden Horses, etc., for Supporting Outer Ends of Work

9- by 3 1/2-inch plate which supports the work. The nut *B* is welded to a 3/4-inch rod by which the jack is raised or lowered. The illustration shows the jack holding one end of a side-rod while the opposite end is being bored. A level is placed on top of the rod, and the end is easily adjusted to locate it horizontally. This jack was suggested by W. H. Hayes, material supervisor in the locomotive department of the San Bernardino Shops.

San Bernardino, Cal. J. R. PHELPS

GRINDING SNAP GAGES

In grinding snap gages and similar tools, there should be no end play in the spindle; otherwise a spoiled job may result. Sometimes when the bearing adjustment is taken up, the spindle tends to become heated. One way to keep the spindle in running condition and yet avoid overheating is shown in the illustration, where *A* represents a hacksaw blade, *B* a ball, and *C* a clamp. The saw blade acts as a spring and prevents end play of the spindle.



Reducing End Play in Spindle

C. KUGLER
Philadelphia, Pa.

Questions and Answers

PATENT PENDING

C. F.—What protection is obtained by placing the words "Patent Pending" on an article, when application for patent protection has been made?

A.—The expression "Patent Pending," as explained by Leo T. Parker in January, 1927, MACHINERY, page 356, may be imprinted upon an invention for the purpose of informing others that the inventor has begun, but not completed, the procedure of obtaining a patent; but it is important to note that no damages can be obtained by the inventor from the person who manufactures or sells the invention prior to the time that the patent is issued, even though the inventor takes the precaution to stamp his product with the words "Patent Pending." In other words, the inventor does not obtain any actual protection by the use of these words.

DIFFERENCE BETWEEN BOLTS AND SCREWS

E. H. D.—What is the difference between a standard bolt, a tap bolt, and a cap-screw?

A.—The difference between a bolt and a screw (such as a cap-screw or a machine screw), according to the generally accepted meaning of the term, is that a bolt extends through the parts to be held together and one or two nuts are used on the threaded end, whereas a screw is inserted into a tapped hole. There are exceptions to this general classification and the definition given is intended primarily to explain the difference in a simple way. A U. S. standard bolt has a thread which conforms to the U. S. standard both as to pitch and thread form.

Cap-screws (like machine screws) ordinarily are inserted in tapped holes and their threads conform to the U. S. standard both as to pitch and form. Many cap-screws are similar to machine screws so far as the shape of the head is concerned, but machine screw threads are of finer pitch. Cap-screws are made in larger sizes than machine screws, and are used generally for heavier work. For this reason, most cap-screw heads, instead of being slotted for a screwdriver like machine screws, are either hexagonal or square, and are intended to receive a wrench.

The term "tap bolt" is sometimes applied to screws of the cap-screw class. The name is evidently derived from the fact that the bolt is inserted into a tapped hole. This name might well be discontinued.

VELOCITY OF FALLING PROJECTILE

J. H. A.—If a rifle is fired while in a vertical position, will the velocity of the bullet just before striking the ground be as great as the initial or muzzle velocity?

A.—If it were possible to conduct this experiment in a vacuum, the bullet would ascend until the retardation due to the force of gravity finally reduced the velocity to zero. Then the bullet, after being at rest momentarily, would be subject to the force of gravity alone and descend with an acceleration imposed by the force of gravity. Under these conditions, the bullet, just before striking the earth, would have a velocity equal to the initial or muzzle velocity.

In the atmosphere, the bullet not only encounters the retardation of gravity, but also the resistance of the air, which varies with the shape of the bullet, its velocity at any time, and the density of different heights. The resistance of the air is enormous, especially at high velocities. The loss due to air resistance is dead loss, both going up and coming down, but the retardation due to gravity on the upward flight is a storing up of potential energy for the downward flight. At some point on its upward flight in atmosphere, the bullet will be arrested by gravity and air resistance, and this point will not be nearly so high up for an equal initial velocity as was the case in a vacuum. As the bullet descends in atmosphere, it is impelled by the force of gravity and is given an acceleration thereby, but the bullet is constantly encountering an ever-increasing density of atmosphere, and, therefore, an increasing resistance due both to atmosphere and to increase of velocity. For each bullet (weight, dimensions, and shape) there is a limiting height. Above that height there is no need of dropping the bullet with an expectation of securing an appreciable increase of velocity at the earth, for the increased speed causes an increased resistance which matches, essentially, the acceleration of gravity.

IF A MINOR IS EMPLOYED MUST THE CONSENT OF BOTH PARENTS BE OBTAINED?

W. H. L.—Is it necessary for an employer to obtain the consent of both parents to employ a minor, or is the consent of one sufficient?

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

Generally, the law is that where the parents are living together, it is necessary for the employer to obtain the consent of the father to relieve himself of liability, and the Courts have held on numerous occasions that the consent of the mother will not suffice; but it is not required that the consent of both parents be obtained. However, after the death of the father, the mother is legally entitled to receive the earnings and financial assistance of her minor children and, therefore, the employer is responsible in damages to the mother in the same respect as he is to a living father, in cases where a minor is injured while illegally employed. For this reason, the employer must obtain the consent of the mother, if the minor is under the care of the mother, whether the father is dead or separated from his wife.

The British Metal-working Industries

From Machinery's Special Correspondent

London, October 15, 1927

IT is possible at last to record that the promise, held out during the recent months of depression, of a general autumnal revival in the machine building and metal-working industries shows definite signs of fulfillment. It is true that the unemployment figures for the whole country are still far from satisfactory, and that their downward progress is painfully slow, but the present total of 1,048,000 is in large measure attributable to the dull conditions in the coal industry.

The Annual Shipping, Engineering, and Machinery Exhibition was held at Olympia from September 8 to 24. The machine tool industry was poorly represented, being confined in the main to German machine tools which are excluded from the Machine Tool Exhibition that will be held in September, 1928. Exhibitors were well satisfied, however, and the number of orders placed on the prevalence of inquiry augurs well for the future. Portable and small tools were fairly well represented, and here again inquiry was brisk.

The large number of oxy-acetylene welding and cutting machines exhibited indicated clearly the rapid progress that has been made in these directions of late. The replacement of castings by fabricated welded structures may well prove to be one of the most important lines of progress in machine design in the near future.

In view of the extended credit demanded by buyers in many countries, the government has found it desirable to insure exporters against bad debts by taking up to 75 per cent of the credit risk. Under this scheme, which is now being vigorously pushed, it is a fundamental condition that goods to be covered must be wholly or partly produced or manufactured in the United Kingdom. By making it possible for exporters to grant long periods of credit without involving undue financial risk, the scheme should have an important effect on the development of export trade.

Conditions in the Machine Tool Industry are Variable

Machine tool makers are generally much better employed than for some time past; indeed some firms report that they find it necessary to work over-time. It appears that from North to South, conditions in this industry vary. Birmingham, on the one hand, and Glasgow, on the other, represent the two extremes. In the former case, the flourishing condition of the industry may be attributable to the proximity of the automobile industry area, and further to the fact that machine tool makers in this district rely for orders on a large number of industries. In Glasgow, on the other hand, the new machine tool market is rather stagnant, but this is due in large measure to the dull conditions prevailing in the shipbuilding industry on the Clyde. In Halifax, conditions are patchy, some machine tool manufacturers complaining of a lack of inquiry and the long delay that ensues before definite orders are placed. In Manchester and Sheffield, conditions may be described as being fairly satisfactory.

Overseas Trade in Machine Tools Continues to Improve

The returns for August continue to show the improvement in exports that has been noticeable over the last three months. The exported tonnage of machine tools rose from 1251 tons in July to 1387 tons in August, with a rise in value from £129,544 to £148,030, while the ton value rose slightly from £104 to £107. The figures for imported tonnage have fallen from 590 in July to 464 in August, but despite the fact, the value has risen from £87,569 to £91,354, with a consequent sharp rise in ton values from £148 to £197.

The value of small tools and cutters exported shows a slight increase, amounting to £53,414 as compared with the July figure of £48,275. In this trade, the small fluctuations balance one another, with the result of a practically steady export. There is an increasing difficulty in estimating the state of trade, in deciding whether tonnage or value is of more importance. In making an analysis on value only, a fairly steady trade is indicated from 1922 to 1927, except for a depression in 1924, and there has been a general upward tendency.

Iron and steel production for the whole country showed a reduction during the month of August. The number of furnaces in blast at the end of the month was 165, a net decrease of 9, compared with the total in operation at the end of July. The production of pig iron in August amounted to 596,100 tons compared with 645,800 tons in July and 651,300 tons in June. Production included 195,500 tons of hematite, 188,000 tons of basic, 159,700 tons of foundry iron, and 26,000 tons of forge pig iron. The production of steel ingots and castings amounted to 644,500 tons in August, compared with 687,100 tons in July and 747,300 tons in June.

The Automobile Industry Prepares for the Show

Motor car manufacturers are now preparing for the rush of orders that may be expected to follow the Motor Show at Olympia. A feature of interest at the Show will undoubtedly be the increasing number of six-cylinder cars for the 1928 season. These new "sixes" are generally about 16 or 17 rated horsepower, and develop some 50 brake horsepower.

Recently long distance motor bus services have been established from Newcastle to London and from Newcastle to Glasgow, and there can be little doubt that firms running road passenger transport services are making more and more determined efforts to strike at the long distance passenger transport monopoly hitherto enjoyed by the railways.

The Machine-building Industries

ALTHOUGH indexes of production show an increase in industrial activity, as compared with the early summer months, there is current in business circles a feeling of doubt which does not appear to be warranted by the essentially healthy business conditions in almost every part of the country. *Commerce and Finance* sums up the situation by saying: "One is led to believe that most of the current pessimism is born of comparing present business with that of the phenomenal activity of last year. It is too much to expect business to enjoy a perpetual boom." This seems to be an accurate diagnosis of present business sentiment.

The Federal Reserve Board records increased industrial production; reports from the engineering construction field are as optimistic as ever; car loadings not only continue at a high figure, but have increased during recent weeks; and while residential building construction has receded to some extent, the total from the beginning of the year shows a shrinkage of less than one per cent, compared with last year's figures.

Car loadings have been over 1,100,000 per week, a small percentage less than in 1926, but more than in 1925. Iron and steel production in September, while running below the corresponding month last year, was greater than in 1925. The automobile industry, excluding the Ford Motor Car Co., has had a greater production than last year.

Hence, everything considered, there is little ground for pessimism on the score of the records of industry and business up to the present time; and in view of the present tendency toward an upward trend in most industrial fields, the next few months are likely to be a period of satisfactory business. This is borne out by the report of the Atlantic States Shippers' Advisory Board. Referring to the next three months' business, as indicated by demands for freight cars and other shipping requirements, the board, at its meeting early in October, gave out the following statement: "Most industries will equal, if not surpass, the volume of business handled during the corresponding period last year." W. J. L. Banham of New York City, the general chairman of the board said, "As regards business in general, it is good and will become increasingly so during the remainder of the year."

It Is Still Too Early to Note the Full Effects of the Machine Tool Exposition

There was a slight falling off in orders in the machine tool industry during September, due doubtless to the holding off in the placing of orders on account of the Cleveland exposition; but many machine tool builders booked substantial orders at the show, and a great many inquiries have resulted from the exposition. While these have not yet materialized into orders, so that a definite statement of the effect of the exposition on the sales of machine tools cannot be made, it is believed by many of the exhibitors that the next few months will see an increased volume of business.

Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association, states that there is nothing in sight at this time to indicate any slackening of business activity during the remaining months of the year. "There is no doubt," says he, "that the machine tool exposition in Cleveland will have an effect for several months to come, in that it will bring out many an order that has not previously been forthcoming, because the owners of old machinery did not realize how very obsolete their equipment was until they came to the exposition and saw the difference between the equipment that they are using and the tools on display."

In the small tool field, there has been no marked change. There is a fairly active demand for small tools, but one of the great difficulties this business has to contend with is the hand-to-mouth buying. Jobbers, dealers, and users, all place very small orders, generally expecting immediate deliveries. In some instances, the orders are so small that their total value is less than the clerical and shipping room cost of putting the order through. The placing of small orders for regular stock goods will eventually force up the prices of small tools, because it is impossible for the manufacturers to continue to absorb the increased clerical and handling costs of small orders without being in some way compensated for this additional expense. The hand-to-mouth buying policy still prevails in other lines of business as well.

There is Little Change in the Iron and Steel Industry

There has been no appreciable change in the rate of operation in the iron and steel industry during the last two months. On October 1 there were 179 blast furnaces in operation, compared with 215 furnaces a year ago. Inquiries for structural steel are growing, but orders are still less than the average for last year. The larger steel companies operate at about 70 per cent of capacity. A hopeful sign is that some large rail orders, to be filled during the coming year, have been placed.

Production in the Automobile Industry

The total output of the member companies of the National Automobile Chamber of Commerce for the first nine months of the year was 2,605,804 cars, compared with 2,377,453 cars during the same period last year, an increase of approximately 10 per cent. The output during September this year was almost exactly the same as during the corresponding month last year; hence, except for the output of the Ford factories, the automobile industry is holding its own. The General Motors Corporation established a new high record of output during the third quarter of the year, shipping 440,000 cars and bringing up the total for the year to 1,325,000 cars.

New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

GREENLEE AUTOMATIC SCREW MACHINE

Recent developments in the machine tool line of Greenlee Bros. & Co., Rockford, Ill., include a four-spindle 1 1/4- by 6-inch automatic screw machine in which are incorporated some mechanical movements that are unusual in screw machine design. The tool-slide is operated through its cycle by means of a rack attached to the slide, and intermittent gearing between the ways, which function in combination with a plate cam to position the slide at the ends of its stroke and keep it in the proper relation to the intermittent gearing. The quick-return, approach, and feeding cycle of the slide is controlled by adjustable dogs which operate high- and low-speed clutches. A section of the tool-slide is an inverted T.

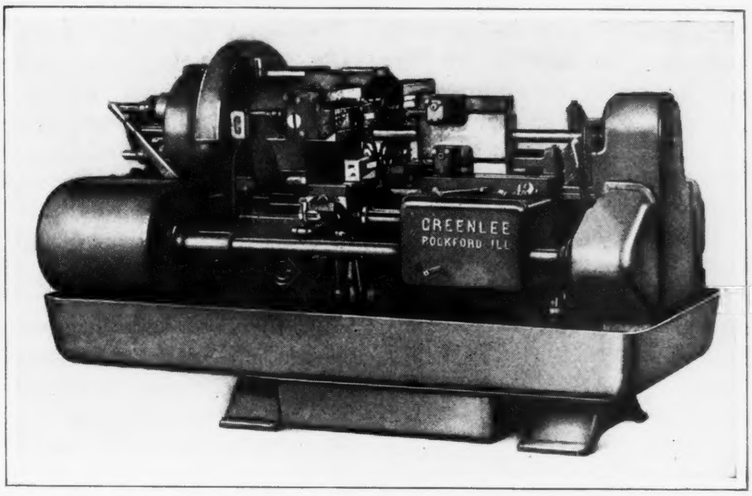


Fig. 1. Greenlee Motor-driven Four-spindle Automatic Screw Machine

Each spindle is mounted in four Timken tapered roller bearings, and the drive gear is carried in the center. The spindle carrier is a one-piece casting having provision for eliminating end motion, so as to insure accurate cut-off duplication. Indexing of the spindle carrier is accomplished by means of a combined Whitworth crank motion and a Geneva movement driven from the main gear-box. The locking pin is a wide wedge, securely gibbed in the spindle carrier housing. It locates in the center of the carrier in an adjustable hardened and ground seat, which is straight on one side and tapered on the other. Indexing and stock feeding take place between the fourth and first positions, thus leaving the fourth position for end operations as well as cutting off.

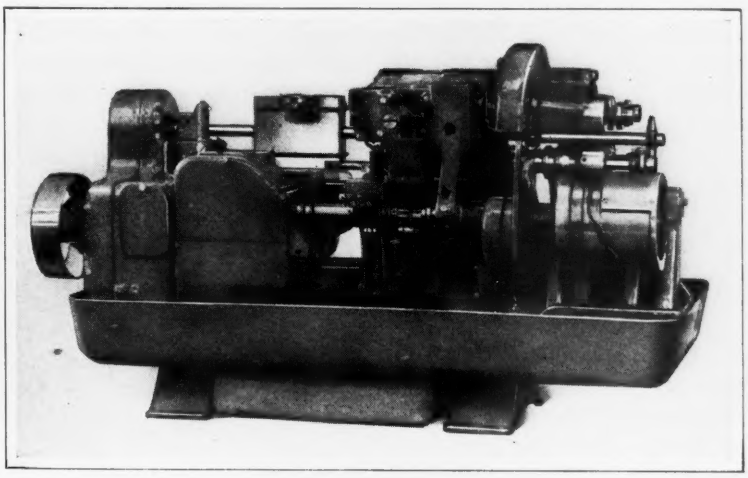


Fig. 2. Rear View of Automatic Screw Machine Equipped with Single-pulley Belt Drive

The chuck-closing spools mounted at the rear of the spindles are made in three pieces, consisting of a bronze body which is free on the spindle, and a rotating spool and hardened sleeve which are mounted on the body. The entire unit is automatically lubricated through the spindle. Instead of the spool rotating in the operating shoe, it rotates on the bronze body and has a rolling action in the shoe when indexing. The stock pusher ring is free to rotate on the feed-tube. The shoes are carried on parallel-motion arms, with rollers engaging drum cams for the movement. The stock pusher shoe is arranged with a compensator spring to prevent breakage of the stock pushers when the stock is exhausted.

Four cross-slides are provided, one for each spindle. They are mounted on bearing brackets attached to the frame and spindle carrier. Movement is obtained by a rack and a segment arm controlled by small pick-off cams and two rollers, for positive travel in both directions. Independent feeds are available for all four slides through cams that are interchangeable for each position. The maximum travel of the slides is 1 1/4 inches.

All gears and shafts in the speed and feed box mounted at the end of the machine are made of alloy steel, heat-treated, and mounted on either ball or roller bearings. Pick-off gears which are accessible through doors in the box are provided for spindle speed and feed changes. Spindle speeds ranging from 250 to 1200 revolutions per minute are obtainable, and feeds from 0.002 to 0.015 inch per spindle revolution. An adjustable safety clutch mounted on the main worm drive shaft functions in case of an overload on the tool-slide.

A geared pump, which is quickly detachable for inspection, is located in the bottom of the speed box, and distributes oil from a reservoir to practi-

cally all moving parts of the machine, including the speed box gearing and bearings, spindle gearing and bearings, tool-slide, cross-slides, and their operating parts. A glass tube on top of the head indicates whether the oil is flowing properly. There is a self-contained coolant system which eliminates all piping to tools carried on the tool-slide or cross-slides.

With an individual motor drive, the motor is mounted on the front of the bed below the spindle carrier and is protected by a shield, as may be seen in Fig. 1. Power is transmitted to the speed box by a housed longitudinal shaft at the front of the bed. For a single-pulley belted drive, a plate is removed at the end of the speed box and a bracket which carries a pulley, shaft, bearing, and gearing is attached, as illustrated in Fig. 2.

BESLY DISK GRINDING MACHINES

Four disk grinding machines of new design were introduced to the trade at the Cleveland Exposition by Charles H. Besly & Co., 120-B N. Clinton St., Chicago, Ill. These machines are shown in the accompanying illustrations. Fig. 1 shows a No. 6 twenty-inch dry belt-driven machine, equipped with a semi-automatic feeding fixture to facilitate rough-grinding the sides of individually cast piston-rings. Rings from the smallest size up to and including 5 inches in diameter can be handled. The production ranges from 40 to 100 rings per minute, depending upon the amount of stock removed and the surface area ground. The machine employs steel disk wheels set up with abrasive disks 20 inches in diameter by 1/2 inch thick.

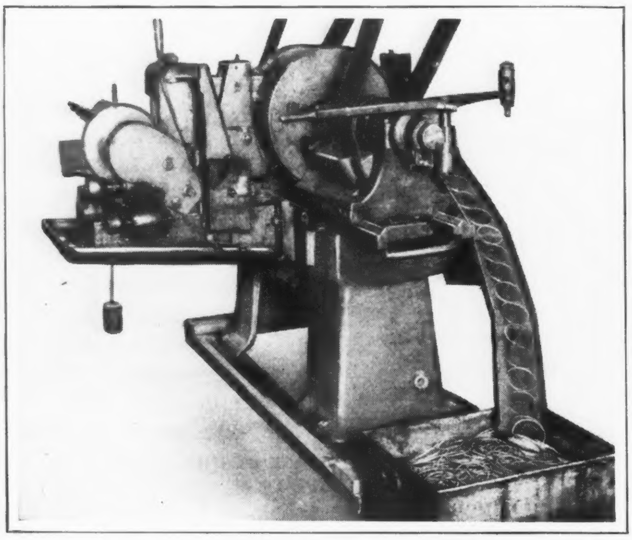


Fig. 1. Besly Disk Grinder for Finishing Piston-rings

In use, the operator merely places the rings in the feeding trough, gravity forcing them against a rotary feeding disk, which picks off each ring successively and carries it to the pressure feed-rolls. These rolls force the ring into guides between the grinding disks, then across the central portion of the grinding disks, and finally out at the rear of the machine, where it drops on a chute and slides into a receptacle.

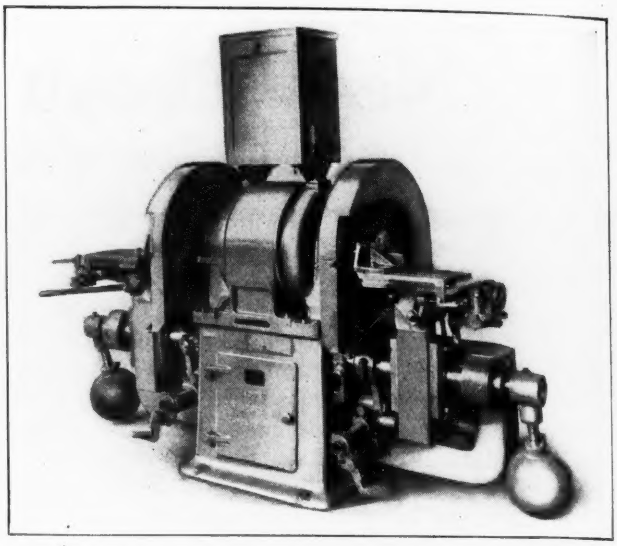


Fig. 2. Grinder with Power-operated Oscillating Tables

Another horizontal machine shown was the No. 161 thirty-inch direct-connected motor-driven dry disk grinder illustrated in Fig. 2. This machine is equipped with power-operated oscillating tables having both a geared-lever and an oil feed for operating the table top to and from the grinding wheel. An oil-feed cylinder, attached to the back of each table guide, operates on the table top.

In using this machine, the operator places the work in position on either of the tables, pushes the table forward, trips a latch with his foot to engage a lock-bolt with a connecting-rod, and then pushes the oil-valve lever over to force the work against the grinding wheel. A micrometer stop-screw on the front side of the table is set to suit the amount of stock to be removed, and when the table top comes in contact with the stop, the feeding ceases. The operator then reverses the valve lever to withdraw the work from the grinding wheel, and at the same time, steps on the foot-pedal to disengage the spring bolt so that the table can be drawn forward for reloading. An automatic starting compensator with a push-button control is mounted on top of the motor.

A No. 49 fifty-three-inch direct-connected motor-driven vertical-spindle dry disk grinder is shown in Fig. 3 equipped with a special double fixture for grinding off punch burrs from the bottom face of rough nuts. This fixture consists of two parallel top bars which carry vertically adjustable shoes having hardened steel faces that press down on the nuts. Side guide bars which are adjustable in or out, provide a channel across the face of the

Fig. 3. Vertical Grinder Equipped for Removing Burrs from Nuts

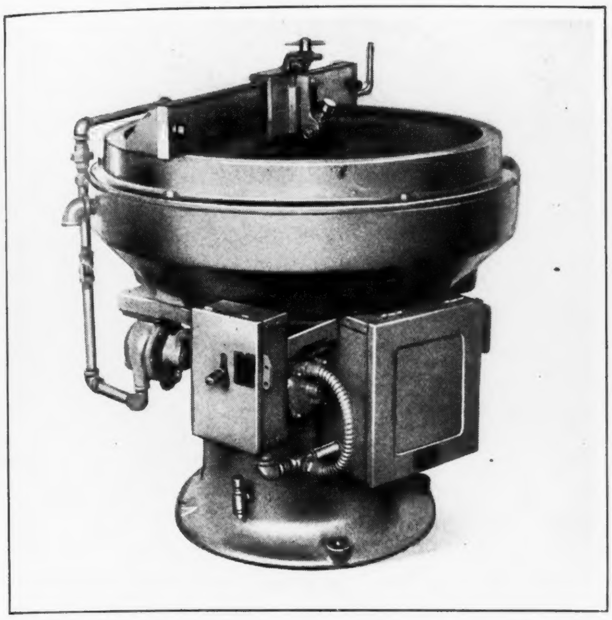


Fig. 4. Another Motor-driven Vertical-spindle Disk Grinder

grinding disk for various sizes of nuts. The top bars are slanted slightly toward the discharge to bring the nuts to the same finished thickness. The nuts are automatically pushed through the grinding channels by adjustable-stroke levers. Various rates of feed are obtainable, ranging from 50 strokes per minute for 1 1/4-inch nuts to 100 strokes per minute for 5/8-inch nuts.

Fig. 4 shows a No. 309 vertical-spindle motor-driven grinder equipped with a disk wheel 30 inches in diameter by 1 1/16 inches thick. The spindle speed of this machine is 865 revolutions per minute, and the rated thrust load capacity is 2000 pounds. The height of the disk from the floor is 33 inches. An alternating-current vertical-type motor of 10 horsepower is used. The net weight of the machine is 1565 pounds.

BARBER-COLMAN REAMER SHARPENER AND REAMERS

Hand-stoning of cutting edges to obtain reamers of the desired accuracy is eliminated with the system of reamers and reamer sharpening machine developed by the Barber-Colman Co., Rockford, Ill. This system was briefly described in September MACHINERY, page 32, and the reamer sharpener was illustrated. The present article will describe mechanical details of the machine and reamers. As they are designed to be in step with each other, the reamers cannot be used without the machine, and vice versa.

Fig. 1. Illustration Showing Relation of Auxiliary Platen to Main Platen of Reamer Sharpener

In the base of the machine are openings for housing the motor, the change-gears, and the apron that carries the table oscillating mechanism. The machine rests on a three-point bearing which tends to eliminate vibration. A two-horsepower motor running at 1150 revolutions per minute supplies power. In the drive to the grinding wheel pulley, there is a cone clutch which is engaged by means of a large centrifugal spring and is released by sliding the drive shaft lengthwise. The latter movement is controlled by means of a multiple screw shaft and a lever mounted at the front of the machine. This construction makes it possible to control the starting and stopping of the platen within approximately 1/8 inch of the desired position for setting.

A cam and shaft with a worm-wheel and bevel gears are used for reversing the motion for grinding right- or left-hand spiral reamers. Universal joints and a telescoping shaft provide the connection between the camshaft and the change gear-box. This gear-box is mounted on the end of an auxiliary swivel platen, and provides for automatic indexing. The auxiliary platen is mounted on the main platen, being pivoted at one end and rolling on flat ball bearings to permit a sensitive movement for following the form of the cam at the other end. Fig. 1 illustrates the position of the auxiliary platen relative to the main platen.

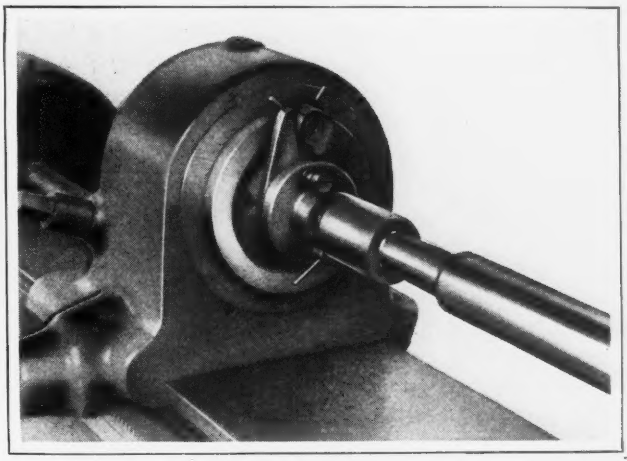


Fig. 2. Method of Driving the Reamer from the Headstock

A sleeve gear construction in the headstock permits the use of a dead center and allows for driving the work dog around it. The headstock is provided with a special driver by means of which definite cutting and relief angles may be determined. It is unnecessary to make special settings for each angle. Fig. 2 shows how the reamer is driven from the headstock, while Fig. 3 illustrates the tailstock, and shows the position of the reamer relative to the setting gage and grinding wheel. The finger is moved out of position after setting, and is not used to guide the blades.

The cam slide-block is mounted on the base at the free end of the auxiliary platen. Two slides are provided, one for grinding back tapers, and

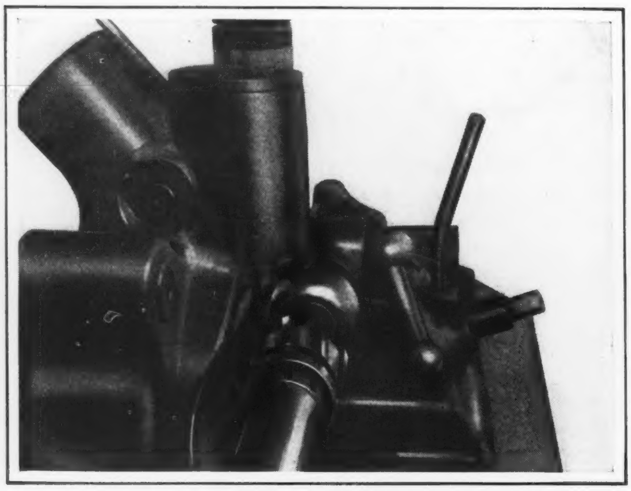


Fig. 3. Position of the Reamer in Relation to the Setting Gage and Grinding Wheel

the other for varying the length of bevel on the end of reamers while grinding, without changing clearances or the form of nose. There are four interchangeable nose beveling cams which permit grinding reamers for "through-hole," "bottom-hole," hand, and cylinder reaming operations. Cams can also be provided for special reamers.

Feeding-in of the spindle is accomplished through a rack and pinion mechanism and a worm-gear reduction. The grinding wheel is a 4-inch diameter straight cup-wheel, the same wheel being used for taking roughing or finishing cuts. The wheel guard is provided with a diamond, which is used for dressing the wheel while the work is in position. The machine weighs about 4000 pounds.

Shell reamers can be furnished with either adjustable blades or the solid type. Adjustable-blade chucking reamers can be furnished with either straight or Morse taper shanks, as well as solid fluted chucking reamers. Hand and jobbers' reamers are regularly made with a Morse taper shank and with spiral flutes only. Special fluted reamers having a pilot can be furnished with either straight or tapered shanks. Adjustable-blade cylinder reamers are made in various sizes up to 7 inches in diameter. Barber-Colman reamers can be supplied in sets with the necessary bars for line-reaming such work as crankshaft and camshaft bearings. These are only a few of the styles of reamers made by the company for use with the sharpening machine.

In the adjustable-blade reamers, a pin and wedge construction holds the blades firmly in the body without the use of screws. These reamers consist of the body, adjusting ring, blades, wedges, and pins. The adjusting ring is used as a guide for lining up the blades when setting the reamer to size. After the wedges have been driven home, the collar is not used until the next resetting.

GIDDINGS & LEWIS PLANER-TYPE BORING, DRILLING AND MILLING MACHINE

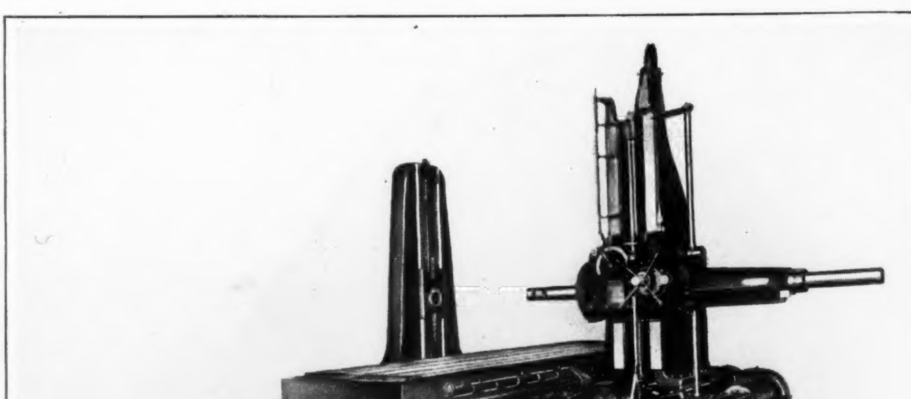
A new planer-type horizontal boring, drilling, and milling machine has been brought out by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., which was designed with a view to producing a precision machine of increased capacity. In the construction of this new machine, which is designated as the No. 45-P, the spindle head of the standard No. 45 machine, with its compact design, is employed. Furthermore, the feed and transmission units, with their chrome-nickel steel gears, and the ball-bearing speed-box, with its "Twin Disc" clutch sensitive control, are attached to the bed.

The complete machine is made up of three main units that are bolted, doweled, and tongued together. The head, column, and all sub-units for speeds, feeds, etc., constitute one unit. The end support and its bed, on which the support can be moved back and forth and clamped in any desired position, is the second unit. The planer bed and table, which are placed at right angles to the spindle, comprise the third unit.

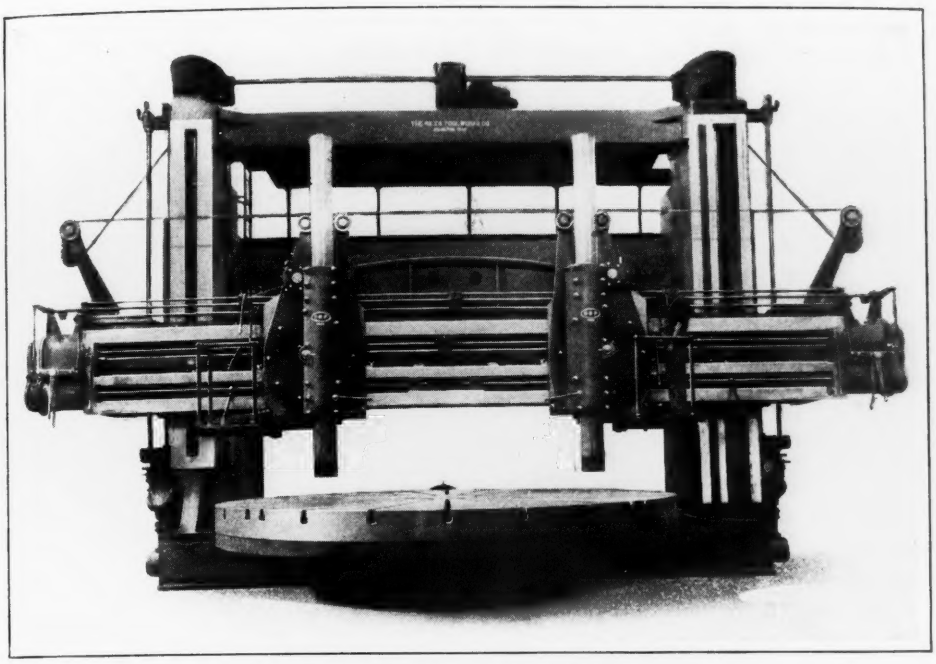
The end support and column with their beds are of the same general design as the corresponding parts on the standard No. 45 machine, except that they are much larger and considerably heavier. The guide block on the end support always moves up and down in unison with the head. The table and bed are provided with large V-ways and a forced-feed lubrication system.

Hand and power feeds and rapid traverse of the table are provided in either direction, and there are hydraulic clamps for clamping the table in any desired position. All of these are conveniently controlled from the operating position. A particular advantage claimed for this type of machine is that even with a long cross travel, the table is always supported for its entire length. The G & L horizontal boring-machine precision measuring device can be supplied for the table and head movements.

Important specifications of the machine are as follows: Maximum spindle travel, 66 inches; number of spindle speeds, 12; range of spindle speeds,



Giddings & Lewis Planer-type Horizontal Boring, Drilling, and Milling Machine



Niles Heavy Boring and Turning Mill of New Design

from 7 to 220 revolutions per minute; and weight of machine, approximately 72,000 pounds. On the standard machine, the maximum distance of the spindle above the table is 64 inches; maximum and minimum distances from the spindle sleeve to the end support, 84 and 64 inches, respectively; working surface of table, 14 feet by 52 inches; and maximum cross travel of table, 13 feet 10 inches. Any of these dimensions can be changed to suit requirements.

NILES HEAVY BORING AND TURNING MILL

A 20-foot boring and turning mill recently built by the Niles Tool Works Co. Division of the Niles-Bement-Pond Co., 111 Broadway, New York City, closely follows the design of the 18-foot machine described in May MACHINERY. However, the right-hand housing of the new machine is of considerably heavier proportions than the left-hand housing, and the housing face is wider and is provided with a three-track bearing to receive a side-head, as may be seen from the illustration.

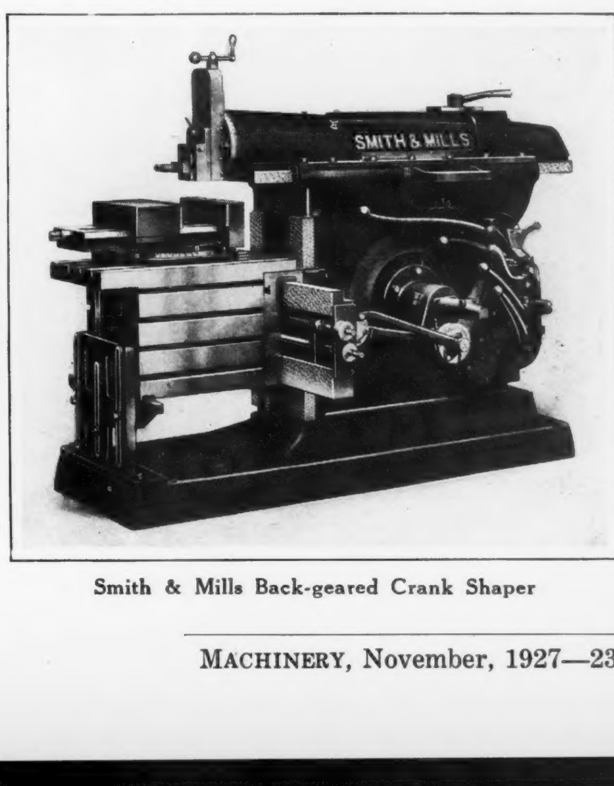
Both the saddle and bar feed for either head may be engaged simultaneously for cutting tapers, and this, in conjunction with swiveling the saddles, enables tapers to be cut that are not obtainable by simply using the down feed in connection with swiveling the saddles. Engagement of the combined feeds is obtained through positive clutches housed in gear-cases at each end of the rail. The regular feeding and rapid traverse movements of the saddles and bars, however, are operative through large friction clutches. A single lever with an interlock between the positive and friction clutches is the medium for changing over from positive to friction feeds and vice versa. Power for the rapid traverse of the bars and saddles is obtained from motors located at the ends of the rail. These motors are inactive except when the rapid traverse is in operation.

The rail is clamped to the housings by means of four electric devices, being held both on the inside and outside of the housings. One-half-horsepower motors operating through a worm and segment furnish power for this purpose. The machine is driven by a 50-horsepower direct-current variable-speed motor, and a 20-horsepower motor is employed to elevate the cross-rail. As on the 18-foot machine, other features include double table tracks furnished with pressure lubrication; sliding-gear feed boxes; a square box-section cross-rail, with a stiffening beam; the elimination of top mechanism by the use of separate motors for the rapid traverse; direct-reading micrometer dials for the saddle and bar movements; a limit switch for controlling the elevation of the cross-rail; and a built-up girder, in addition to the top brace.

SMITH & MILLS CRANK SHAPER

One of the features of a 32-inch back-geared crank shaper now being introduced to the trade by the Smith & Mills Co., 2889-91 Spring Grove Ave., Cincinnati, Ohio, consists of a one-shot hand-operated lubricator which supplies oil to all main revolving shaft bearings, to the ram ways, and to parts located inside the machine. This lubrication system, in general, comprises a supply tank, a pump, and three distributing units or headers having eighteen outlets. The volume of oil delivered to each bearing is determined by the size of the air-control chamber installed on the header for that particular bearing.

Either a motor or a single-pulley drive can be provided. With the former type, the drive is accomplished by a fiber pinion on the motor shaft meshing with a large gear on the shaper driving shaft. A "Twin Disc" clutch and self-acting brake



Smith & Mills Back-geared Crank Shaper

are controlled by means of a long lever which extends close to the operator, starting and stopping being controlled independently of the motor. With the second type of drive mentioned, the single pulley is mounted on tapered roller bearings.

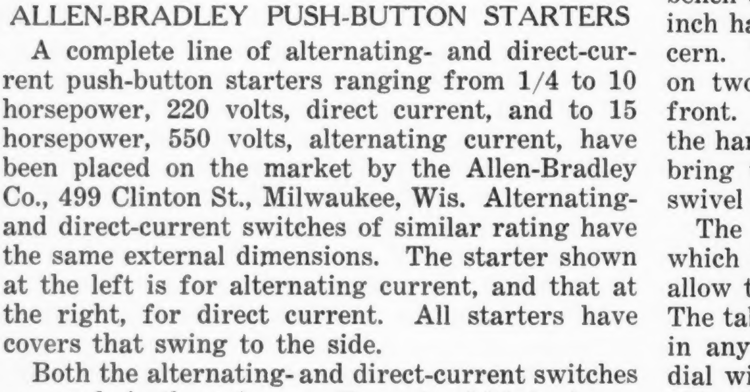
Four speed changes are obtainable through a gear-box bolted to the back of the column, which, in combination with the back-geared drive, affords eight ram speeds. Adjustment of the wrist-pin gear for changing the length of stroke can be accomplished with the machine in operation. There is an internal ratchet feed, and vertical and horizontal feeds are obtainable automatically in either direction. The feed-rod is equipped with a graduated disk which shows at a glance the number of notches being used ranging from 1 to 15 in variations of 0.010 inch per notch.

Some of the important specifications of this shaper are as follows: Extreme length of stroke, 32 1/4 inches; maximum cross motion of table, 32 3/4 inches; total vertical adjustment, 15 inches; maximum and minimum distances between table and ram, 17 1/4 and 2 1/4 inches, respectively; and weight, about 6500 pounds.

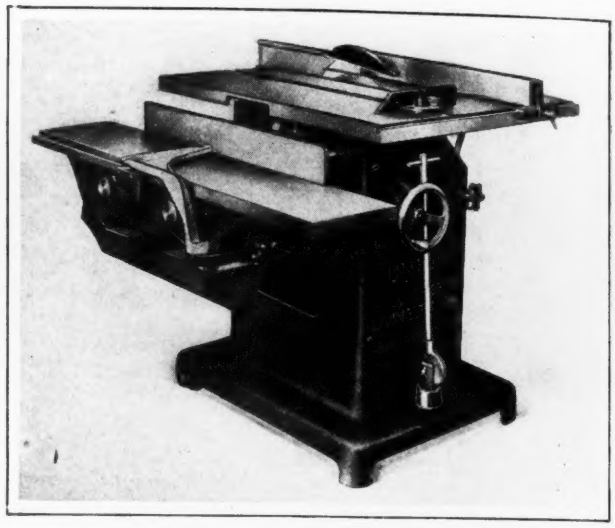
ALLEN-BRADLEY PUSH-BUTTON STARTERS

A complete line of alternating- and direct-current push-button starters ranging from 1/4 to 10 horsepower, 220 volts, direct current, and to 15 horsepower, 550 volts, alternating current, have been placed on the market by the Allen-Bradley Co., 499 Clinton St., Milwaukee, Wis. Alternating- and direct-current switches of similar rating have the same external dimensions. The starter shown at the left is for alternating current, and that at the right, for direct current. All starters have covers that swing to the side.

Both the alternating- and direct-current switches are made in three forms. Form 1, which is shown in both examples of the illustration, has the start and stop push-buttons mounted in the cover, reducing installation and wiring costs. Form 2 is designed for operation with an outside push-button, float switch, etc., while Form 3 has a lever on the cover which gives a two-way control, manual and automatic. The alternating-current starters give protection against overload, no-voltage and single-phase operation, while the direct-current starters give positive starting, no-voltage and overload protection.



Allen-Bradley Push-button Starters



"Union" Combination Universal Saw and Jointer

"UNION" COMBINATION SAW AND JOINTER

A combination machine of motor-on-arbor design has recently been produced by the Gallmeyer & Livingston Co., 344 Straight Ave., S. W., Grand Rapids, Mich., by combining the universal saw bench described in August MACHINERY with an 8-inch hand jointer, manufactured by the same concern. The base of the combination machine rests on two rollers at the back and two feet at the front. Portability is obtained by merely lowering the handle to raise the two feet from the floor and bring the weight on a third roller carried in a swivel bearing that moves with the handle.

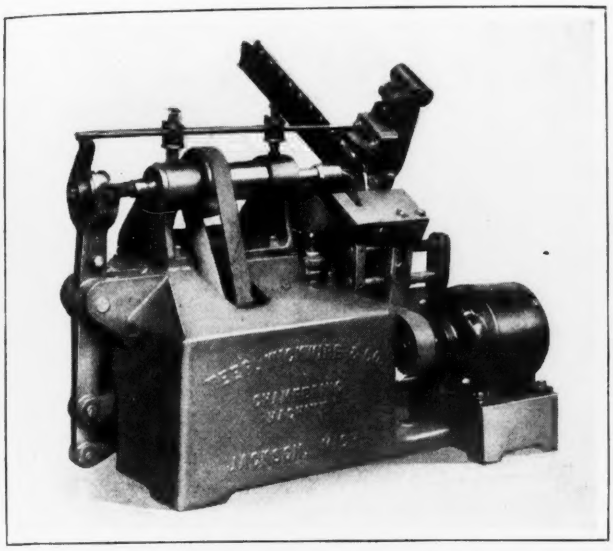
The machine has a 30- by 34-inch saw table which is fitted with a removable throat plate to allow the use of a dado head, grooving saws, etc. The table tilts up to 45 degrees, and may be locked in any setting, the position being indicated by a dial with graduations and a pointer. A stop provides for quickly returning the table to the horizontal position. Cross-cut and ripping gages may be used on either side of the saw. The saw is 12 inches in diameter and is mounted on the motor arbor. It may be raised high enough to cut stock 2 1/2 inches thick.

The jointer has a 24-inch front table and an 18-each rear table. By means of the vertical adjustment provided for the front table and the rabbeting groove in the rear table, it is possible to cut rabbets up to 1/2 inch deep. Stock up to 8 inches wide may be handled. The jointer is equipped with a three-knife safety cylinder. The fence may be set at any desired position on the front table.

When operating either the saw or the jointer, if it is desired to use the other unit, all that is necessary is to drop the saw to its lowest position and move a slip collar to engage the unit to be used.

TEER-WICKWIRE AUTOMATIC CHAMFERING MACHINE

Holes in automatic screw machine products are chamfered at rates varying from 60 to 100 pieces per minute in a machine recently developed by Teer, Wickwire & Co., Jackson, Mich. The production



Teer-Wickwire Chamfering Machine

is limited only by the ability of the operator to place the parts in the magazine. The machine has a capacity for parts from 3/8 to 1 5/8 inches in diameter, and from 1/8 inch to 2 inches in length. An attachment can be supplied for chamfering hexagonal or octagonal parts. The machine is furnished set up for any part within its range; to chamfer other parts, it is merely necessary to change the magazine and ejector-plate, which can be done in five minutes.

For chamfering, each part is located approximately concentric with the chamfering tool, a jaw gripping the part, centering it, and holding it from turning. The spindle that carries the tool then advances, chamfers the part, and returns to its rear position, while the gripping jaw releases. The ejector-plate removes the bottom part of the column of parts in the magazine and the column then rolls downward the space of one part to bring another piece in position for chamfering. This machine weighs approximately 450 pounds.

"MORCO" DROP-FORGED CONVEYOR CHAIN

Both open-link and closed-link types of chain for general use on conveyors, drag lines, monorail installations, etc., are now made by the Moore Drop Forging Co., Springfield, Mass. The patented construction of this "Morco" chain embodies only two parts, a center link and a side link. They are easily taken apart or assembled instantly without the use of tools. Also, the chain can be taken apart at any link. The design makes it impossible for links to buckle or come apart in service. The high-carbon steel from which the chain is made resists the corrosive effects of sulphur, water, or acidulous ores.

Either malleable or drop-forged attachments, such as scrapers, pushers, trolley extensions, bucket attachments, etc., are also furnished. The malleable attachments are secured to the center links by bolts, while the drop-forged attachments are formed integral with the side links.

CINCINNATI MACHINE TOOL SPINDLE GRINDING MACHINE

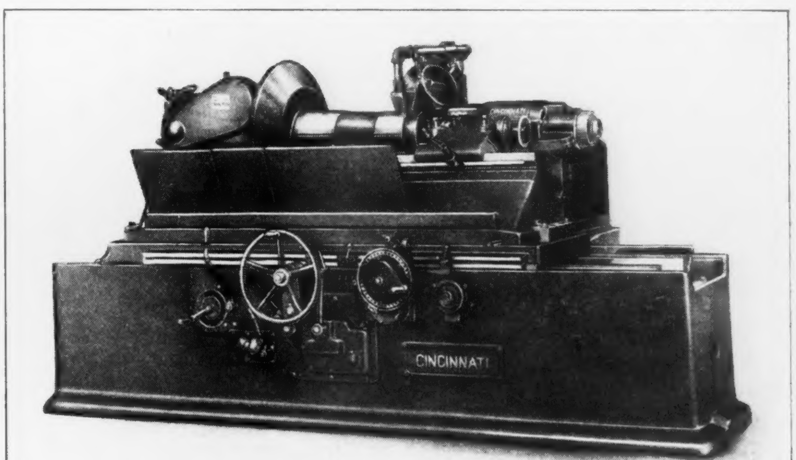
A heavy-duty grinding machine constructed particularly for obtaining good finish and accurate surfaces on large machine tool spindles is the latest addition to the line of grinding equipment built by Cincinnati Grinders, Inc., Cincinnati, Ohio. This machine was developed from one of the standard machines built by the concern, and will grind work up to 48 inches long. The normal swing of the machine is 16 inches, but work 31 inches in diameter can be swung through the gap in the table.

All control levers are easily reached by the operator from his position in front of the grinding wheel. The headstock is controlled by a lever at his left, which operates an electro-dynamic control panel. Proper work speeds for any diameter within the range of the machine can be obtained through a rheostat located at the right of the operator. The desired table traversing speed can be obtained through another lever at the right, which operates sliding gears in a speed box located at the rear of the machine.

The headstock is driven by a two-horsepower variable-speed motor through worm-gearing. The motor is mounted at right angles to the line of centers, so that any vibration which the motor may set up will not cause chatter marks on the work. The complete assembly of the slide weighs 1600 pounds, this weight, together with the downward pull of the drive, holding the wheel-slide down on the ways even under the heaviest cuts.

The machine carries a 26-inch diameter grinding wheel having a 4-inch face. The wheel is driven through "Texropes" from a 20-horsepower motor mounted in the bed directly below the wheel-spindle. This mounting eliminates jack-shafts, conserves floor space, and offers protection to the motor, as well as simplifying the installation of the machine. The grinding wheel spindle is located in bronze half bearings, and is lubricated automatically. Oil is carried from a well in the base of the wheel-slide to distributing pockets in the spindle cap by means of centrifugal slingers on the spindle. End thrust on the spindle is taken up by a double row of ball bearings.

One of the features of the machine is the forced lubrication system for the table ways. A pressure of from 2 to 3 pounds per square inch is exerted



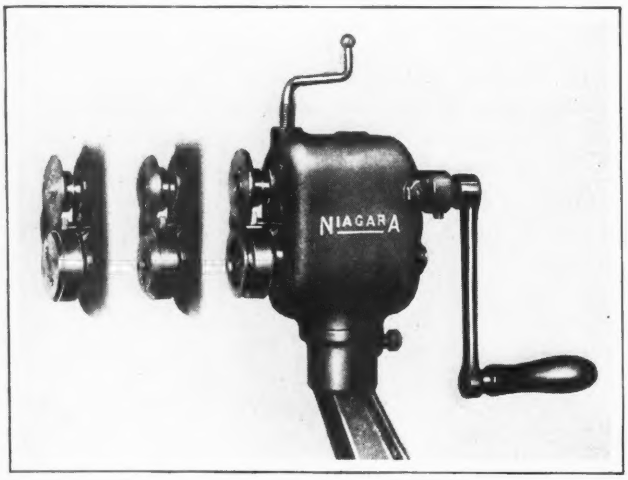
Cincinnati Machine Tool Spindle Grinding Machine

on the oil by means of a small geared pump, which is used to pump the oil from a central tank through a filter into a pipe leading to the table bearings. On the pressure line there is a valve that automatically controls the flow of oil to the bearings.

The bearing surfaces of the sliding table are designed to provide headers or leads for the oil stream, and diamond oil-grooves cross these headers in such a way as to give a uniform oil film over the entire bearing surface of the sliding table. The oil-grooves on the table run out at the ends to allow the oil to circulate to the bed bearing surfaces, and then drain to settling reservoirs at each end of the bed. The oil finally flows back to the central pump tank.

NIAGARA COMBINATION BENCH MACHINE

Turning, wiring, and burring operations in sheet-metal and tin shops, etc., can be conveniently performed by means of a combination bench machine manufactured by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. This machine is provided with interchangeable faces or rolls for performing the operations mentioned. In the illustration, turning faces are shown



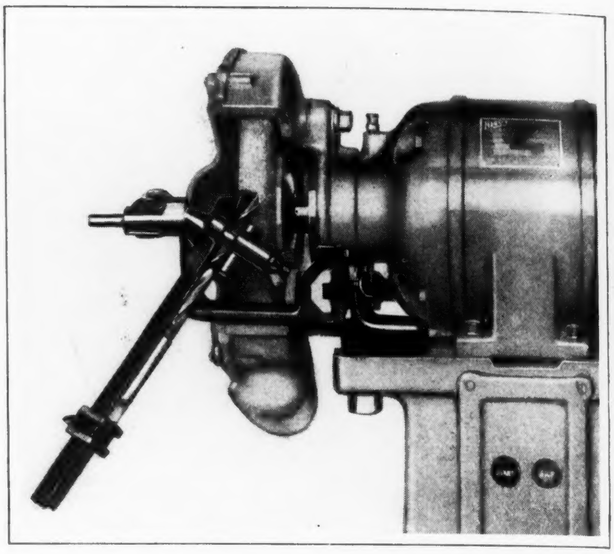
Niagara Machine for Turning, Wiring, and Burring Sheet Metal

on the machine, while the faces to the left of these are used for wiring, and those at the extreme left, for burring.

The bearings for the lower shaft are contained in the solid metal of the frame, while the upper shaft is pivoted at the back. The faces are hardened and polished, and are easily removed from the shafts when others are to be substituted. There is a gage which is provided with a fine screw adjustment and a locking nut. The upper face and shaft can be adjusted laterally for variations in the thickness of the material. In an operation, this shaft is actuated through a direct-acting crank screw, although a treadle attachment can be provided. The machine has a capacity for stock up to No. 22 gage.

HISEY TWIST-DRILL GRINDING ATTACHMENT

A twist-drill grinding attachment recently brought out by the Hisey-Wolf Machine Co., Cincinnati, Ohio, is shown in the accompanying illustration fitted to a 10-inch grinder. The complete



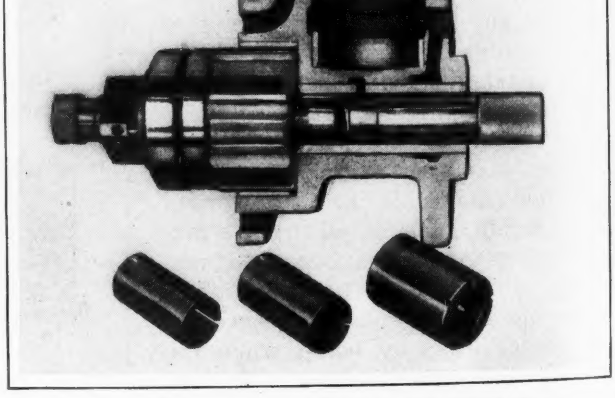
Hisey Twist-drill Grinding Attachment

drill grinding unit is interchangeable with the standard tool grinding rest, and can be quickly mounted in position. With this attachment, twist drills can be ground accurately, and the use of gages is eliminated, since a graduated micrometer screw adjustment insures identical lip lengths. Straight- or taper-shank twist drills from 1/4 to 1 1/4 inches in diameter, inclusive, may be ground. The attachment can be used with wheels up to 12 inches in diameter, on the left-hand side of grinders only.

FOSTER-JOHNSON TRIPLE-VALVE REAMER GUIDE

A sleeve and expanding adapter have been placed on the market by the Foster-Johnson Reamer Co., Elkhart, Ind., for piloting the triple-valve reamers made by this concern centrally with the slide valve bushings. The sleeve is bored and ground internally at the top end to receive the pilot which extends from the reamer body. At the opposite end, the sleeve is threaded to receive a knurled hand-nut, and a tapered seat begins where the threaded portion end is ground.

Split adapters which have tapered holes to fit the tapered seat on the sleeve are provided for various sizes of slide valve bushing holes. Four of these comprise the complete set for the AB-12 reamer. In using the equipment, the knurled nut



Foster-Johnson Reamer Guide for Triple Valves

is first removed from the sleeve and the proper size of expanding adapter is placed over the tapered seat, after which the nut is replaced. The entire sleeve and adapter are then inserted in the valve, as illustrated, and the nut is tightened against the adapter. The opening in the end of the sleeve is next centered ready to guide the reamer pilot.

"SUPERBA" FLEXIBLE-SHAFT GRINDERS

Two models of a heavy-duty flexible grinder have recently been placed on the market by the Sirianni & Trumbettas Co., Carbondale, Pa. One of these models consists of the portable unit illustrated, which is mounted on a column or pedestal that can be conveniently transported about the shop. The other model comprises a unit which may be suspended from the ceiling for doing work in one location. This model is similar to the portable unit, but the pedestal, of course, is omitted.

Both models are driven by a one-horsepower motor which runs at 3600 revolutions per minute.

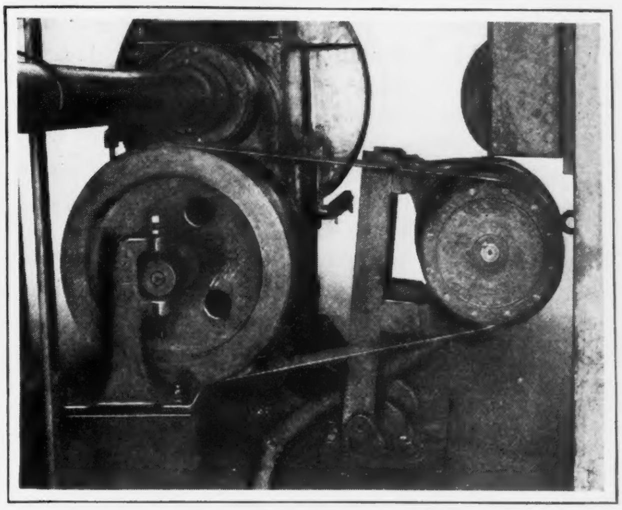
Flexible-shaft Grinder Brought out by the Sirianni & Trumbettas Co.

The flexible shaft carries a ball-bearing hand-piece at both ends of the shaft—the tool end and the driven end. The driven end is supported by a collar secured to the motor base, which keeps this end in line with the motor through a flexible coupling, without binding or friction.

The flexible shaft is 7 feet 6 inches long, and the core or driver is 5/8 inch in diameter, being capable of carrying grinding wheels up to 10 inches in diameter. In addition to grinding, these units may be used for polishing, buffing, drilling, wire-brushing, etc. A right-angle drive can be furnished for sanding operations on automobile bodies, metal furniture, castings, etc.

ROCKWOOD "UNI-PULL" SHORT-CENTER BELT DRIVE

The principal advantage claimed for a "Uni-Pull" short-center belt drive recently developed by the Rockwood Mfg. Co., Indianapolis, Ind., is that



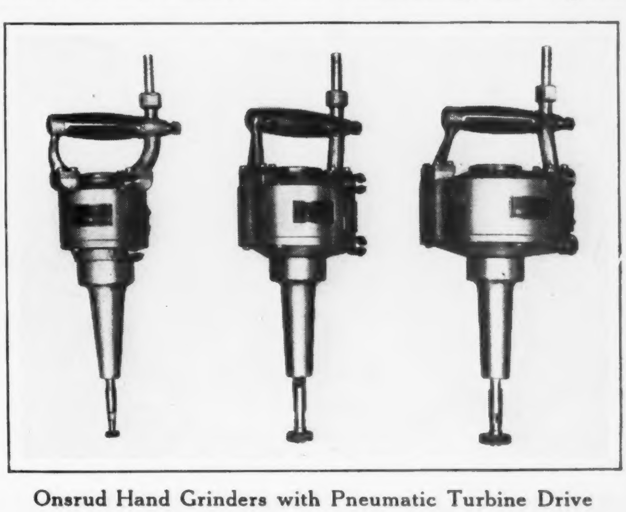
"Uni-Pull" Short-center Belt Drive

the belt will operate with uniform tension, pull, and speed at all times. Briefly, the new drive consists of a Rockwood paper pulley and a motor, so mounted that gravity maintains the belt under a predetermined tension to meet the power requirements of the installation. The center-to-center distance between the driving and driven pulleys is not fixed. A typical installation is illustrated.

In tests conducted by the manufacturer, belts have been run at centers so close that the pulleys almost touched. The method of mounting the drive makes it possible to maintain the tension independently of the effect of centrifugal force, and there can be no temporary strains due to shrinking as a result of atmospheric conditions. The drive has already been adapted to installations requiring from 30 to 50 horsepower and frequently operating under a 50 per cent overload.

ONSRUD PNEUMATIC TURBINE HAND GRINDERS

A light-weight hand grinder having a pneumatic turbine drive is manufactured in three types by the Onsrud Machine Works, Inc., 3900-3932 Palmer St., Chicago, Ill. This device is particularly suitable for such operations as grinding drop-forging and die-casting dies. Type E-3-C, shown at the left in the illustration, has a speed of 28,000 revolutions per minute, weighs 8 pounds, and uses a 1-inch diameter wheel; type H-3-C, which is shown at the middle of the illustration, has a speed



Onsrud Hand Grinders with Pneumatic Turbine Drive

of 20,000 revolutions per minute, weighs 9 pounds, and uses a 1 1/2-inch wheel; while type K-3-C, which is shown at the right, has a speed of 14,000 revolutions per minute, weighs 10 pounds, and uses a 2-inch diameter wheel.

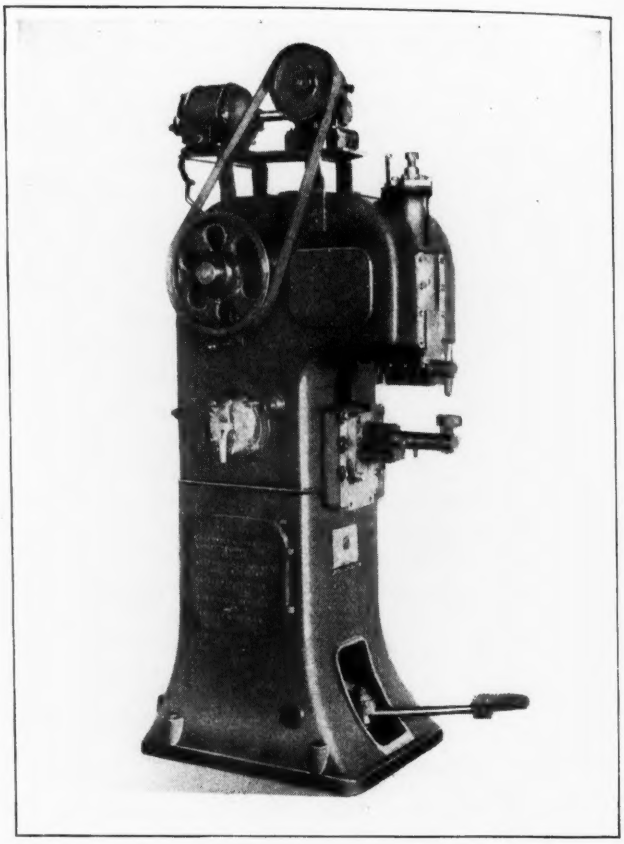
Each of these types of grinders is driven by a three-stage turbine, which has no wearing parts except the bearings, and these are kept cool by the exhaust air. Air consumption is regulated by turning the handle grip, a quarter turn being sufficient to open or shut the valve completely. The grinder may be suspended from the ceiling to eliminate weight in die work. Various styles of interchangeable extension spindles may be furnished.

GIBB WELDING PRESS

A welding press just developed by the Gibb Welding Machines Co., Bay City, Mich., constitutes a combination automatic spot welder and punch press in that the welding points are brought to and from the work by means of a toggle action. Through the adoption of a new principle in spot welding, welds are made in 1/100 part of a second. This is accomplished by means of a special transformer and a precisely timed automatic switch. In its action the transformer has the characteristics of a condenser, discharging current with lightning-like swiftness. It is stated that the weld is made before the heat has an opportunity to soften the outer surfaces of the sheet, with the result that there are no depressions in the surface, and no warpage or discoloration. Welds can be made at the rate of 200 or more per minute.

The toggle action quickly brings the welding points lightly into contact with the work and gives a final forging pressure which can be without limit. There is no hammering of the copper points, the smoothness of action preserving the points.

The machine may be used on the polished surfaces of automobile bodies and parts or for welding spouts to bodies of oil-cans, coffee pots, tea kettles, etc. Another special application is in welding rivets, pins, or rods on end to flat surfaces. The machine may also be used for welding utensils made from non-ferrous metals, such as brass and aluminum. In attaching ears, clips, or lugs to containers, a special double-acting press is used, which produces two spot welds at one stroke.

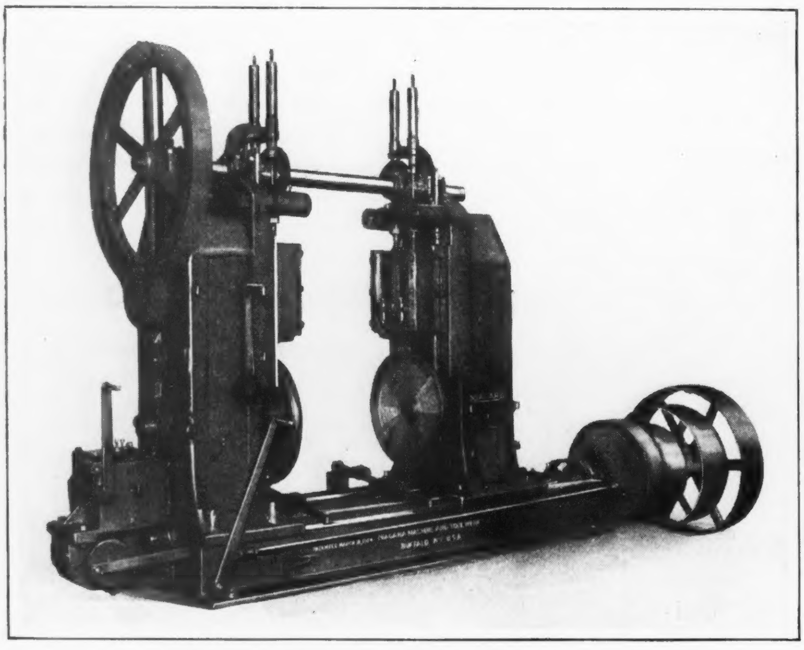


Gibb Welding Press with Slide for Upper Welding Point

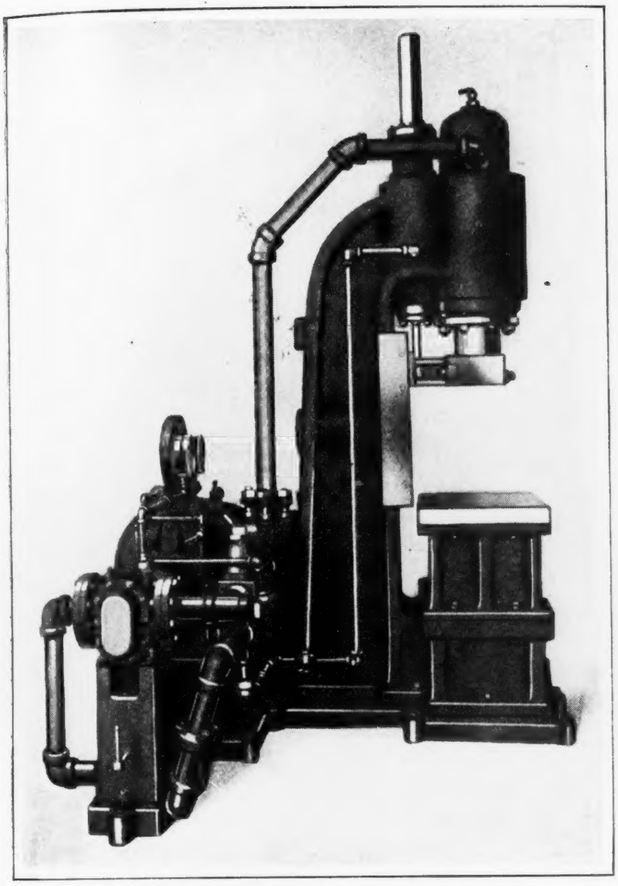
NIAGARA DOUBLE-END SEAMER

Both ends of light-steel containers and grease drums can be seamed simultaneously in a No. 309 horizontal double-end seamer recently built by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Three control levers within easy reach of the operator make it possible to turn out an average of 300 complete small-diameter containers per hour with this machine, while 55-gallon "one-time shippers" can be double-seamed at the rate of about 125 per hour.

The main spindles which carry the chucks are mounted on Timken tapered roller bearings, and the individual first- and second-operation seaming rolls also run on roller bearings. The motion of the right-hand column which clamps the drum and the motion of the roll cams are controlled by Johnson clutches. Rotation of the seaming chucks is controlled through a large single disk clutch. All moving parts are readily accessible for lubrication and inspection. The machine can be built to be driven either from a lineshaft or by an individual 25-horsepower motor. Complete, the machine weighs about 10,000 pounds.



Niagara Horizontal Double-end Seamer for Light Containers



"Hi-Speed" Hydraulic Stamping Press

HYDRAULIC STAMPING PRESS

Forty-two normal working strokes are obtainable per minute in a hydraulic press intended for stamping operations, which has recently been developed by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. This "Hi-Speed" press can be used for operations requiring a working stroke ranging from a fraction of an inch up to 18 inches. It operates over a wide range of adjustable pressure. An automatic feature prevents the breakage of dies or machine parts.

The power unit consists primarily of an electric motor having a double-ended shaft that is direct-connected through flexible couplings with two hydraulic pumps of the rotary type. The entire unit is mounted on a reservoir base which holds the required supply of pressure fluid. This unit is fitted with all devices necessary for automatic control.

When the foot-treadle is depressed to its extreme position, the automatic cycle commences. The consecutive phases of this cycle are as follows: (a) Press closes at fast speed; (b) automatic shift to slower full-load speed as the resistance of the work builds up; (c) automatic regulation of the maximum pressure; (d) automatic reversal of the direction of ram travel as soon as the limiting pressure is reached; and (e) return to upper position, where the ram stops. This upper ram position is adjustable to any point between the extreme limits of the ram travel.

The single operating treadle may be used when it is desired to control both the direction and speed of the press ram movement manually. The further the treadle is depressed, the faster the downward motion of the ram, while release of the treadle causes the ram to move upward and stop. The maximum pressure capacity of the machine is 75 tons.

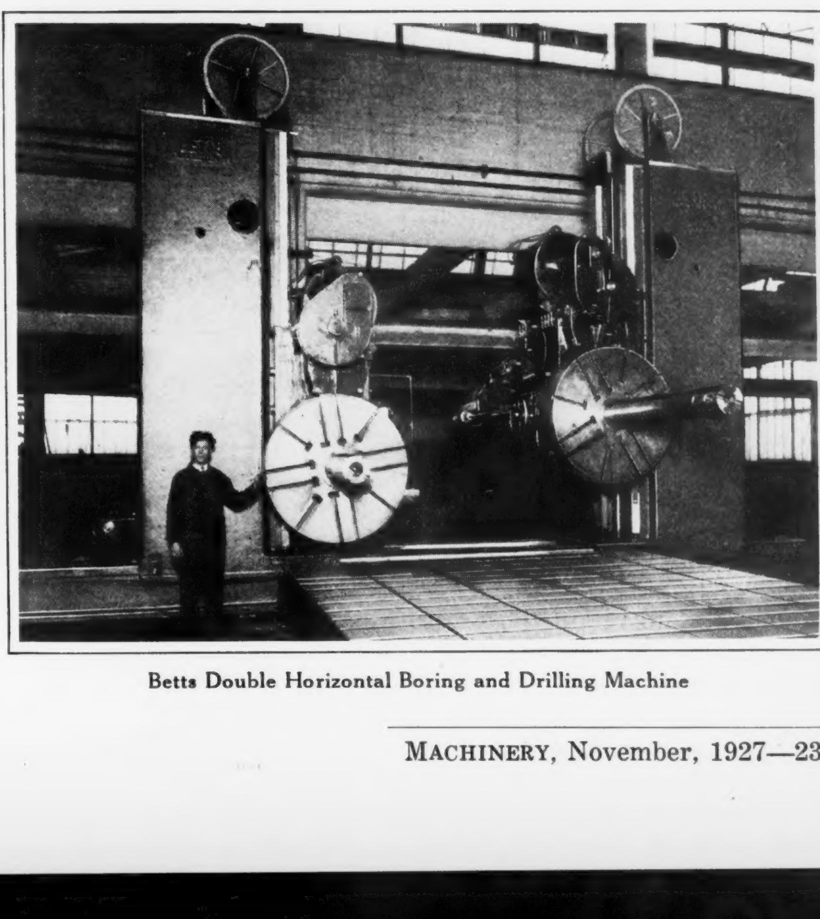
BETTS DOUBLE HORIZONTAL BORING AND DRILLING MACHINE

The large double horizontal boring machine here illustrated was recently built by the Betts Works of the Consolidated Machine Tool Corporation of America, Rochester, N. Y. While this machine was especially designed to perform boring operations on cast-steel locomotive frames having the cylinders cast integral, it is adaptable to a wide range of boring and drilling operations on large work. dle speeds.

The machine has a long bed on which two columns are mounted. Each of these columns carries a saddle provided with mechanism for driving, feeding, and rapidly traversing its spindle. Both spindles are 9 inches in diameter and, in addition to a direct drive, are provided with an internal faceplate drive for heavy boring operations. Each saddle carries a 35-horsepower, 4 to 1 variable-speed motor which, in combination with two mechanical speed changes, gives a wide range of spindle speeds.

The saddles are equipped with an operator's platform from which all movements of the saddles and spindles are controllable. Each saddle unit is counterbalanced by means of a weight contained within the corresponding column. The saddles are raised and lowered by independent five-horsepower motors. There is also a fine hand adjustment.

The left-hand spindle, looking toward the faceplates is arranged to swivel up to 15 degrees from the horizontal. Both spindles have a simplified feed



Betts Double Horizontal Boring and Drilling Machine

mechanism, the range of which may be extended at will by means of pick-off gears. Separate five-horsepower motors provide a rapid traverse to the spindles, and each column is moved along the bed by means of a separate 8 1/2-horsepower motor. Provision is made for giving milling feeds to the saddles and columns when required.

A large floor-plate, provided with a convenient arrangement of T-slots, is bolted to the bed. The top of the floor-plate is so arranged that work may be located and clamped rapidly. Suitable boring-bars, boring heads, facing heads, centering vises, etc., can be supplied. Each spindle is equipped with an outboard support for steadying the boring-bars. All motors have push-button control.

"LOGAN" FOOT-CONTROLLED VALVE FOR AIR DEVICES

To further increase the efficiency of "Logan" air-operated devices by the elimination of waste in time, effort, and motion, the Logansport Machine Co., 529 Market St., Logansport, Ind., has brought out a new type of foot-controlled air-operating valve. The valve is manufactured in the two models illustrated in Fig. 1, in 1/4-, 1/2-, 3/4-, and 1-inch sizes. Both models are of the poppet type

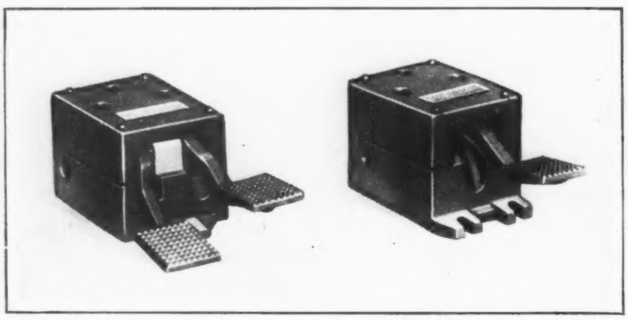


Fig. 1. "Logan" One- and Two-pedal Foot-controlled Air Valves

and are arranged for piping direct to the cylinder. Working parts are hardened and ground, and all parts are made accessible by removing the cover.

The model G valve, at the right in Fig. 1, has a single-pedal control, and is designed for operating devices where air is required on one side of the cylinder piston for a short time only. For example, in unloading and loading a device where the chucking time is of short duration and the work is easily handled by the operator, the action is as follows: The foot-pedal is depressed, admitting air to that side of the cylinder that causes the piston to move in the proper direction for releasing the work jaws, and at the same time allowing the air to exhaust on the opposite side of the piston. After the finished work has been removed and another piece placed in the jaws, the foot is taken from the pedal. The pedal is then automatically raised, and reverses the intake and exhaust of the air, the pressure remaining constant until the pedal is again depressed.

The model H valve has a double-pedal control and is designed for operating cylinders where air is required on both sides of the piston for such a length of time that it would not be practical for the operator to retain the pressure on one pedal all the time. In operation, as one pedal is pushed down, the opposite pedal is automatically raised.

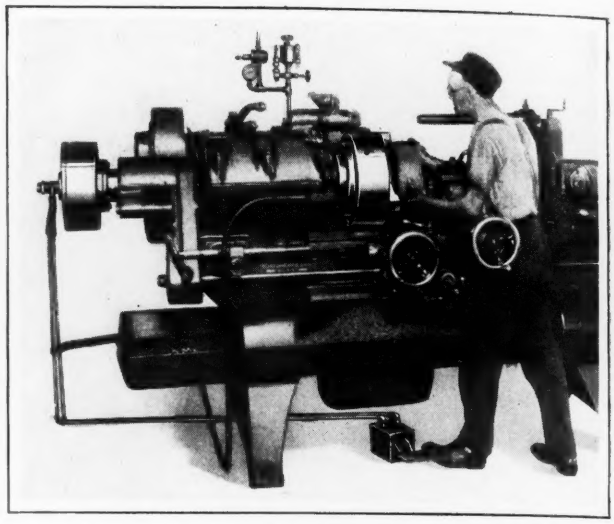


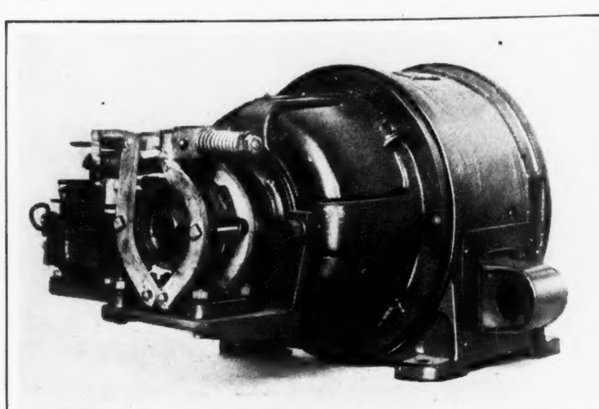
Fig. 2. Application of a Foot-controlled Air Valve to a Turret Lathe

Air pressure then remains constant until the opposite pedal is pushed down to reverse the intake and exhaust. With both pedals on center, the valve is in a neutral position. By the use of these foot-controlled valves, an operator has both hands free.

GENERAL ELECTRIC HOIST MOTORS

A new line of motors, which are intended for portable electric hoists, but are also suitable for other applications involving intermittent operation and high starting torque, are being introduced to the trade by the General Electric Co., Schenectady, N. Y. Motors from 1 to 10 horsepower are included in direct-current types, whereas the alternating-current line includes motors from 1 to 11 horsepower, of single speed for three- and two-phase current, and from 1 to 5 horsepower, for single-phase current. Three- and two-phase, slip-ring type hoist motors are also included from 3 horsepower up.

The new motors are totally enclosed, and all parts are well protected. Bearings are of the waste-packed sleeve type, and are closed against the entrance of dirt from the outside. The direct-current motors are series-wound. Alternating-current motors of the polyphase type have high-resistance rotors, while the single-phase motors have an unusually high starting torque. In many applications, a brake is required and, accordingly, the motors are all built to receive this equipment.

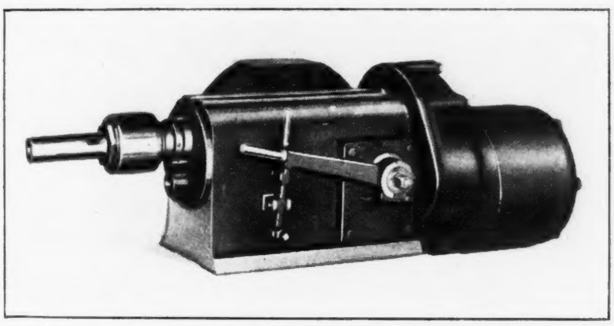


General Electric Motor for Portable Hoists and Similar Uses

DEMCO-BRADFORD DRILLING AND TAPPING HEADS

Two sizes of a unit type drilling and tapping head are being placed on the market jointly by the Demco Drilling Machine Co., Cleveland, Ohio, and the Bradford Machine Tool Co., Cincinnati, Ohio. These heads, one of which is shown in the accompanying illustration, are intended for high-speed automatic drilling, tapping, countersinking, and reaming operations. Except for several new features, these heads are the same as those described in an unillustrated article published in September MACHINERY.

Both heads are of a self-contained type, with the motor and feed mechanism built into one compact unit. One or more heads may be built into a machine or unit, with the spindle at any angle from the horizontal to the vertical. The heads operate on a predetermined cycle, having a definite spindle travel of 3 inches with a 2-inch adjustment. This travel consists of a rapid approach to the work, a cutting feed, and a rapid return after the operation is completed. The cycle is imparted to the spindle by means of a positive feed-cam which makes one complete revolution each time the starting lever is depressed. To make the operation continuous or automatic, the trip-dog for the starting lever is disengaged. An emergency lever provides for instantly stopping the entire mechanism.



Demco-Bradford Drilling and Tapping Head

Spindle speeds can be varied from 75 to 2000 revolutions per minute by means of pick-off gears, and feeds from 0.005 to 0.030 inch per revolution are also available by changing pick-off gears. The depth of actual feed can be varied by changing a cam.

A power take-off rod which extends through the front of the head provides for automatically clamping or locating work, while automatic indexing or dial feeding is accomplished through a crank arm attached to a stub shaft that extends from one side of the head.

The tapping mechanism is built into the head, and a positive rise cam imparts the proper lead to the spindle to correspond with the tap lead desired. Return of the spindle is also controlled by the cam. Thread leads for cutting from 8 to 32 threads per inch can be obtained with standard pick-off gears. The No. 1 head is intended for drilling from 1/4- to 3/4-inch holes and for tapping from 1/4- to 1/2-inch holes, while the No. 2 head, which is illustrated, is intended for drilling from 3/4- to 1 1/8-inch holes and for tapping from 1/2- to 1-inch holes. The No. 1 head requires a one-horsepower motor and the No. 2 head, a two- or three-horsepower motor.

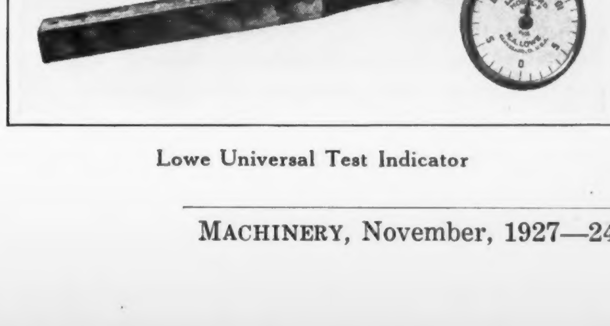
Standard Electrical Tool Co.'s Buffer and Disk Grinder

COMBINATION BUFFER AND DISK GRINDER

A combination buffer and disk grinder of the construction illustrated has been brought out by the Standard Electrical Tool Co., 1938-46 W. Eighth St., Cincinnati, Ohio. It is built in four sizes, of 1/2-, 1-, 2-, and 3-horsepower capacities. The illustration shows a 2-horsepower machine, with a motor wound for alternating current and having a speed of 1750 revolutions per minute. The steel disk is 12 inches in diameter and is arranged to take abrasive disks on both sides, as it is reversible. The table on this machine is 7 inches wide by 14 inches long. It has a vertical as well as a horizontal adjustment. The armature shaft is made of nickel steel, and is fitted with three S K F ball bearings, encased in dustproof chambers.

LOWE UNIVERSAL TEST INDICATOR

A model F "Last Word" universal test indicator recently brought out by Henry A. Lowe, 1874 E. 66th St., Cleveland, Ohio, is shown in the accompanying illustration. This model has a tubular swiveling body which is held tight by friction in a spring clamp. The body can be turned for use on either the right- or left-hand side of the shank,



Lowe Universal Test Indicator

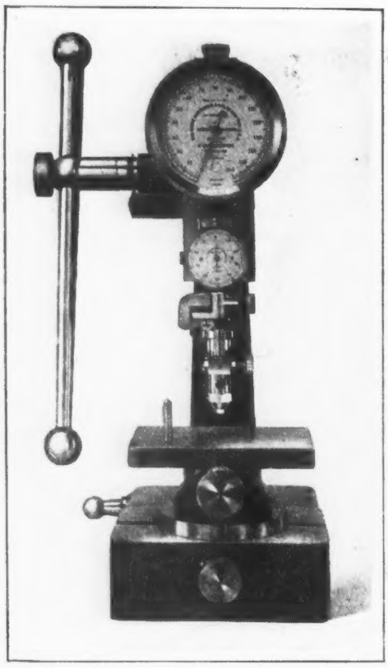


Fig. 1. "Monotron" Hardness Tester

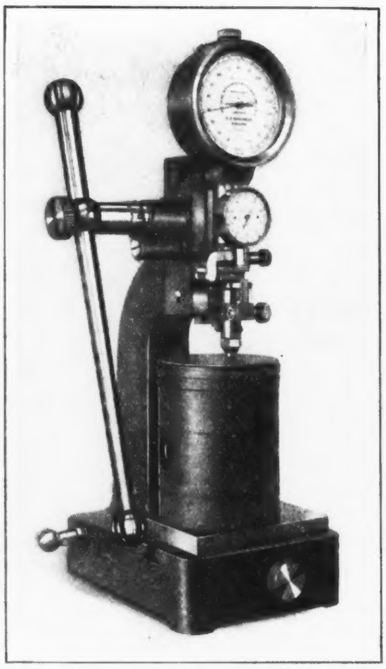


Fig. 2. Testing Hardness of a Piston

as well as on the top. A reversible action is provided by means of a switching lever underneath the dial on the left-hand side, which allows motion in either direction.

The contact piece has fine radial teeth on the flat side, which interlock with corresponding teeth on the long arm of the lever. The two series of teeth are held in contact with each other by a spring clip, which may be swiveled. The contact piece can be pushed into any desired position relative to the long arm, as its teeth will ride over those of the arm and again snap into contact with them. This is accomplished without swinging aside the spring clip, the clip being swiveled only when changing to a different form of contact piece, and this is quickly done without disturbing any adjustments.

The ratio of movement between the contact ball and the end of the pointer is 90 to 1. The range of the indicator is 0.030 inch, and its weight without the shank and with an adjustable dial is 1 1/4 ounces. The new universal shank has a knuckle joint which is held by friction in the shank proper, the latter being provided with a pair of spring jaws. This double joint, together with the swiveling body and the adjustable surface gage button, permits swinging the indicator back, upon itself or over the shank, so that it is possible to make contact with any part of a hollow sphere.

"MONOTRON" CONSTANT-DIAMETER HARDNESS INDICATOR

A "Monotron" hardness indicator has recently been developed by the Shore Instrument & Mfg. Co., Van Wyck Ave. and Carll St., Jamaica, N. Y., for measuring what is known as quantitative and qualitative hardness in metals, minerals, glass, and organic compounds such as rubber. The instrument is a static mechanical pressure machine which acts on a small diamond-ball impressor point through a high-duty weigher or pressure scale. The depth of impression under load is measured by a standard micrometer gage giving readings in increments of 1/5000 inch or 1/200 millimeters. The graduated pressure scale has a capacity of 160 kilograms and also reads in pounds up to 352. A compensator device on the indicator serves to correct hitherto unavoidable errors due to contraction in the parts of the machine and of the diamond itself when under strain.

The diamond ball point is made to penetrate the material to a depth of 9/5000 inch, and the comparative hardness of the metal is measured in terms of the pressure necessary to produce this constant impression. Special scales may be applied to the instrument to read in terms of scleroscope and Brinell hardness numbers, or unit stress values may be used.

The model A instrument is shown in Fig. 1 with a removable tilting table, and in Fig. 2, with the table removed to permit a piston to be tested.

After a specimen has been put on the table, the ram is lowered until the hexagon cap comes into contact with the piece to be tested. At this point, the hand-lever is moved until the lower or micrometer gage hand is moved to a responsive resting position, where it is held while the micrometer needle is adjusted to zero by a thumb-screw. Then the hand-lever is moved again until the idler pressure bar reaches the weigher mechanism, at which point the indicator hand on the large dial begins to move away from zero, and at the same time, the hand on the micrometer gage moves until the required penetration is reached. The pressure reading is then taken from the larger dial in kilograms or pounds. The model A tester has a capacity of 7 inches between the base and impressor point. The greatest distance from the center to the back of the frame is 4 1/4 inches. The tester weighs 61 pounds.

BILTON "PRODUCTO-MATIC"

A larger-sized "Producto-Matic" milling machine, designated as the No. 46, has recently been brought out by the Bilton Machine Tool Co., Bridge-

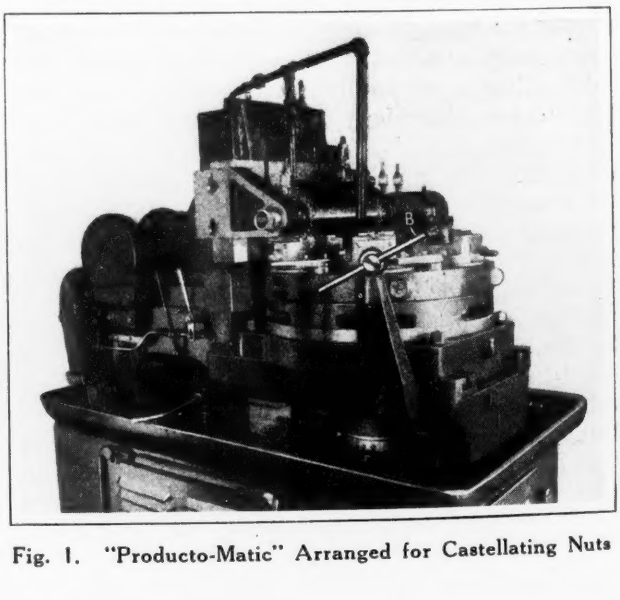


Fig. 1. "Producto-Matic" Arranged for Castellating Nuts

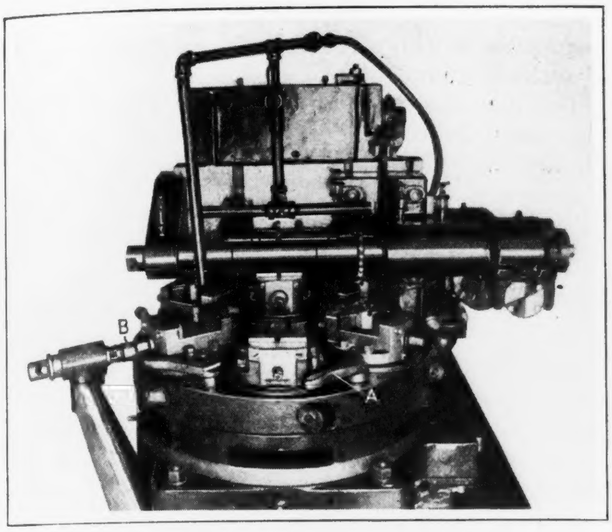


Fig. 2. Indexing Fixture with Vises that are also Indexed

port, Conn., primarily for milling the hexagon sides on nuts and for castellating nuts. The machine illustrated is arranged for castellating 1 1/2-inch hexagon nuts which measure 2 3/8 inches across flats. Six cuts are taken on each nut so as to leave the burrs projecting over the hole in order that they may be removed simultaneously with the tapping operation. Three slots are milled at one time on different nuts by means of three cutters carried on the two spindles.

The machine is mounted on the standard cabinet base. All shafts in the gear-cases are equipped with Timken tapered roller bearings. There is a "Twin Disc" clutch between the motor and the main gear housing, so that the machine can be stopped without shutting down the motor. The turret saddle is adjustable, so that fixtures of different diameters can be accommodated. The turret table and fixture together weigh 1100 pounds.

The fixture has six stations and indexes 60 degrees each time. The particular fixture illustrated has a vise at each station, which is mounted on a spindle. These vises are indexed by hand one-half turn, moving the nuts half way around for milling the slots in the opposite side of the nuts, after three slots have been produced in the first side at one movement of the vises past the three cutters. To index a vise, the operator merely pulls the corresponding handle *A*, Fig. 2. This indexing is performed as each vise is brought into the idle position opposite socket wrench *B* after three of the slots have been milled. When the vises have been fed twice past the cutters, the operation is completed and the vises are brought into the idle position, where they are reloaded.

In operation, the travel of the cutters is vertical, though a horizontal adjustment is available for the double cutter-spindle unit. The vertical movement of the cutter-spindle unit is effected by means of a cam on the camshaft. This cam actuates a lever on which there is a segment gear that meshes with a rack fastened to the vertical slide. A path cam is used so that the stroke for both the feed and return is positive. All movements of the machine are entirely automatic, and the gear transmission is lubricated by means of a forced-feed system. Only three cams are employed to operate the entire machine, one for producing the vertical cutter-spindle movements, another for actuating the indexing movement, and a third for operating the index locking unit.

HOEFER PRODUCTION DRILLING MACHINE

A 5–7 1/2-horsepower high-production drilling machine, recently brought out by the Hoefer Mfg. Co., Inc., Freeport, Ill., has been so designed that when heads, fixtures, indexing tables, etc., are applied, they practically become integral parts of the machine. Efforts were also made in the designing, as may be seen from Fig. 1, to eliminate protruding units or parts such as gear-boxes, driving pulleys, driving motor, handles, etc. When driven by a five-horsepower motor, which is contained within the head, the machine has a capacity for drilling holes up to 1 1/2 inches in diameter in steel and for tapping holes up to 2 1/2 inches in diameter in cast iron; when equipped with a 7 1/2-horsepower motor, holes up to 2 1/2 inches in diameter can be drilled in steel, and holes up to 3 1/2 inches in diameter can be tapped in cast iron.

The base casting contains a sump for the coolant, and has strainers which prevent chips and foreign matter from entering with the coolant. All moving parts pertaining to any of three table feeds which can be provided are contained within the column,


Fig. 1. Hoefer Production Drilling Machine

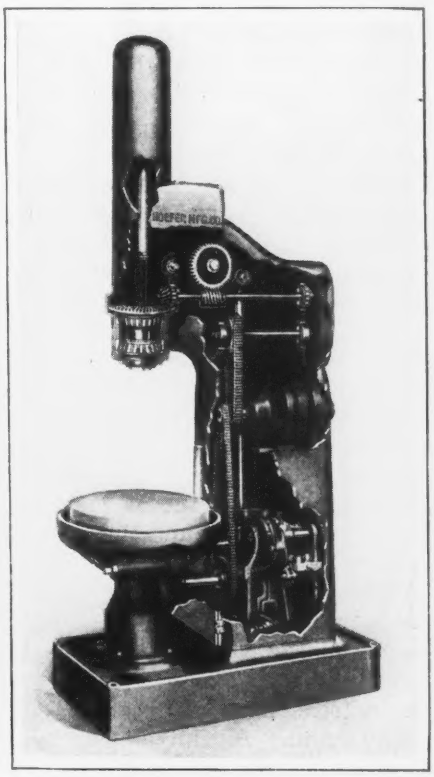


Fig. 2. Arrangement of Mechanism Inside the Machine

as may be seen from Fig. 2. The speed and feed mechanism for the spindle, as well as the motor, are contained within the head. A housing fastened to the head completely covers the spindle and its counterweight.

Power is transmitted from the motor to a constant-speed shaft by means of a silent chain and sprockets. Pick-off gears then transmit the power to a horizontal drive shaft from which it is delivered by means of a helical crown gear and pinion to the lower end of the spindle, close to the work. All bearings are either of the roller- or ball-bearing type and a self-aligning ball bearing for the spindle absorbs the thrust of the work. Eight spindle speeds ranging from 100 to 600 revolutions per minute, and eight feeds ranging from 0.005 to 0.125 inch per spindle revolution are available.

As standard equipment, the table consists of a plain platen surrounded by an oil channel, but an automatic indexing table can be furnished. The number of indexes ranges from 2 to 10, being controlled by means of pick-off gears and timed so that each indexing movement coincides with the table travel. Suitable work-holding fixtures can be mounted on the platen.

A "one-shot" lubricating system is provided. There is a reservoir of ample capacity in the head and a pump inside the column, this pump being operated by a plunger at the side of the machine. Each outlet, of which there are twenty-eight, receives the proper amount of lubricant at one motion of the plunger. The machine is started and stopped by a push-button control. A star wheel is provided for hand operation of the spindle, while a hand-lever within easy reach of the operator controls the power feed.

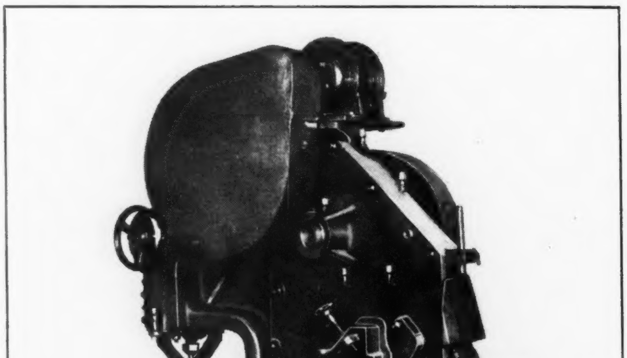
The machine has been so designed as to permit the ready application of multiple-spindle head equipment. Heads of this type are bolted directly against the head of the machine, thereby obtaining a rigid construction. When multiple-spindle heads are used, the spindle speed is replaced or supplemented by either one of the table feeds. The use of a multiple-spindle head and indexing table makes the machine semi-automatic.

When machines are equipped with both spindle feeds and a table feed, the spindle and table cannot be fed at the same time. Either a screw, cam, or hydraulic feed can be supplied for the table, and these feeds may be operated either automatically or by hand. A control lever extending from the base of the column is used to engage any of the table feeds. The table cycle consists of a rapid approach, working feed, rapid withdrawal, and stop. The working feed can be changed by means of pick-off gears.

The distance from the center of the spindle to the face of the column on this machine is 12 inches; the total height of the machine, 109 1/2 inches; the floor space, 30 by 50 inches, and the net weight without the indexing table, 3000 pounds.

RYERSON COMBINATION SHEAR, PUNCH, AND COPER

A machine combining a shear, punch, and coper is the latest addition to the line manufactured by Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts., Chicago, Ill. The punch is capable of handling almost all structural shapes found on the market, and its operation is not interfered with in any way by the other units.



Ryerson Combination Shear, Punch, and Coper

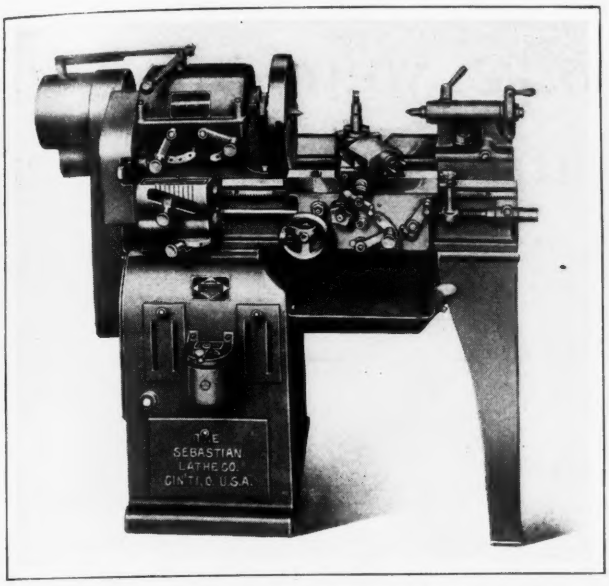
The shearing end of the machine is so constructed that a single slide handles the shearing of angle-irons, cutting of bars, shearing of plates, and coping. The angle shear attachment performs both inside and outside miter cutting, as well as straight shearing. The blades of this unit are made in sections to facilitate replacement.

The bar cutting blades are located directly below the angle shear blades. The plate shearing blades are directly below the bar cutter, and cut plates of any width or length up to 1/2 inch thick. The coping device is built at the shear end of the machine, and is regularly furnished in the V-notch type, but square notching can be provided for.

The punch attachment has a 15-inch throat and capacity for punching 13/16-inch holes through 3/4-inch plate. Flat bars up to 6 inches by 5/8 inch can be sheared, as well as round bars up to 1 3/4 inches, square bars up to 1 1/2 inches, and angle-irons up to 4 by 4 by 3/8 inch. The machine makes 35 strokes per minute, and can be furnished with either the motor drive illustrated or a belt drive.

SEBASTIAN ELEVEN-INCH HEAVY-DUTY LATHE

An 11-inch lathe, designed for use in manufacturing departments, tool-rooms, and trade schools, has recently been added to the line built by the Sebastian Lathe Co., Cincinnati, Ohio. This "Gold Seal" heavy-duty lathe takes collets up to the 7/8-inch size, and has a 1 1/4-inch hole through the spindle. The machine is built with all engine lathe features, and is furnished with either a motor or



Sebastian 11-inch Lathe of Heavy-duty Design

single friction pulley drive. The motor is located in the headstock leg, and can be furnished for operation on either alternating or direct current. Below the motor there is a cabinet for tools, etc. A belt tightener, controlled through a lever at the rear of the leg, is provided for the driving belt.

Eight speeds, ranging from 26 to 620 revolutions per minute, are obtainable through two levers at the front of the headstock. Starting and stopping of the lathe are controlled by means of a lever within easy reach of the operator, which also governs the friction drive pulley. Feeds for cutting from 6 to 96 threads per inch are obtainable through a quick-change gear-box. All feed and thread changes are made through two levers on the quick-change box and one sliding lever on the quick-change tumbler shaft. Reversal for the cutting of left-hand threads is accomplished by shifting the position of a yoke.

Graduations are provided on the tailstock, compound rest, cross-feed collar, and compound-rest collar. A depth stop and chasing dial facilitate the taking of threading cuts. The swing over the bed of this machine is 12 1/16 inches, and over the carriage, 8 3/8 inches. With a 4-foot bed, the maximum distance between centers is 22 1/2 inches. Beds 3, 4, 5, and 6 feet long can be provided.

"PHONO" ALLOY SHEETS, RODS, AND TUBING

"Phono" is the trade name given to a group of bronze alloys high in copper and low in tin and other elements, which have been produced for more than thirty years by the Bridgeport Brass Co., Bridgeport, Conn. Their use in the past has been mainly in the overhead construction of electric railways and electrified steam railroads, but now the alloys are available in the form of wire, rod, sheets, and tubing, for various engineering uses where high strength, toughness, resistance to corrosion, resistance to wear, hardness, and moderately high electrical conductivity are needed.

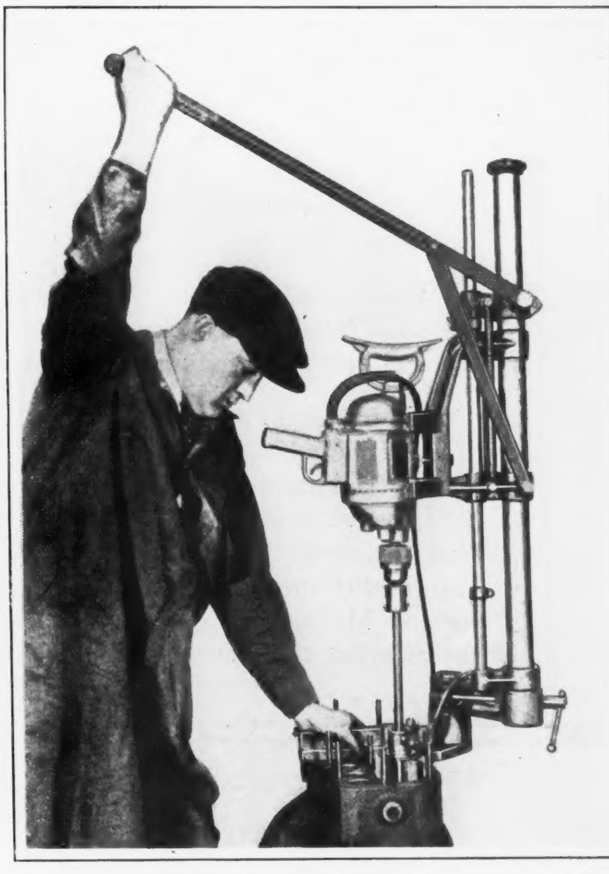
The alloys can be drawn, threaded, machined, formed, hot and cold-forged, soldered, brazed, hot and cold-rolled, plated, pierced, etc. They are grouped under three classifications designated as "Phono Hi-Strength," "Phono-Electric," and "Phono Hi-Con." The alloy known as "Phono Hi-Strength" possesses a tensile strength of from 42,000 to 125,000 pounds per square inch, with relatively low electrical conductivity; "Phono-Electric" has a tensile strength of from 40,000 to 90,000 pounds per square inch and fair conductivity; while "Phono Hi-Con" has a tensile strength of from 38,000 to 80,000 pounds per square inch, together with maximum electrical conductivity approaching that of copper.

"AMMCO" RADIAL CYLINDER-GRINDER STAND

A radial stand has been brought out by the Automotive Maintenance Machinery Co., 549 W. Washington St., Chicago, Ill., for attachment to the top of automobile cylinder blocks to provide an easy means of raising and lowering a portable electric drill equipped with a cylinder grinder during cylinder reconditioning processes. The stand assures a uniform stroking action with little effort. The swinging radial arm enables a mechanic to grind all bores of a cylinder block with only one setting of the tool, including cylinders that are located close under the cowl.

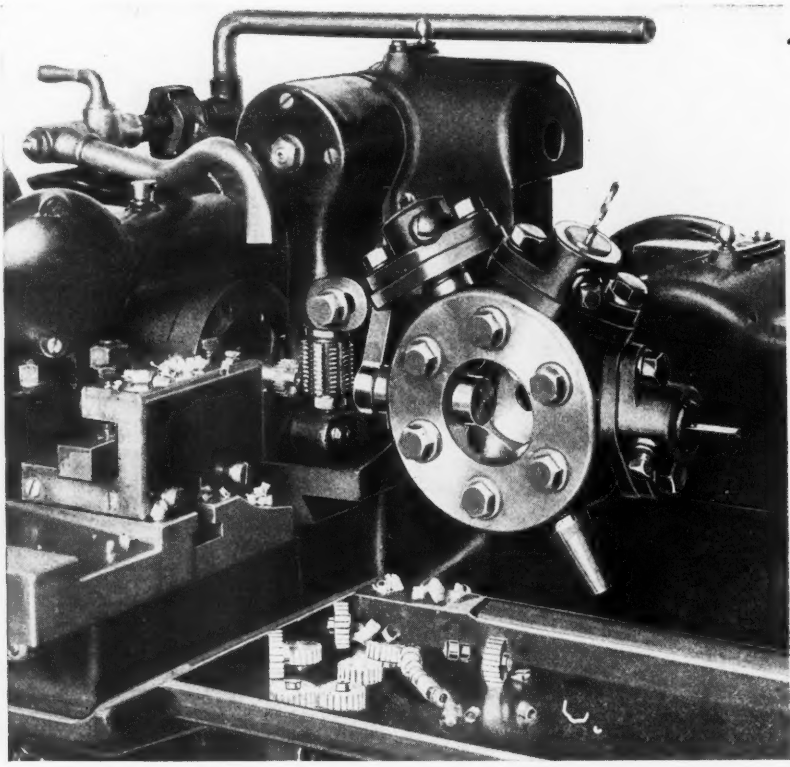
Another feature of the stand is that the central column is hollow and will receive three quarts of kerosene. The kerosene is brought to the cylinder bore from the bottom of the column through a flexible tube, the drip being controlled by means of a small cock.

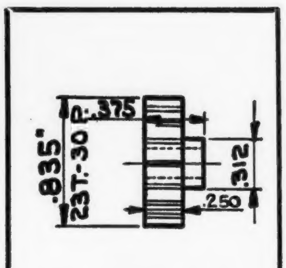
Two stops are provided on the central column to limit the up and down travel of the grinder in the cylinder bore. They prevent the grinder from



"Ammco" Radial Stand for Use in Grinding Cylinder Bores

Ready to help solve your production Brown & Sharpe Screw Machine Service and Brown &



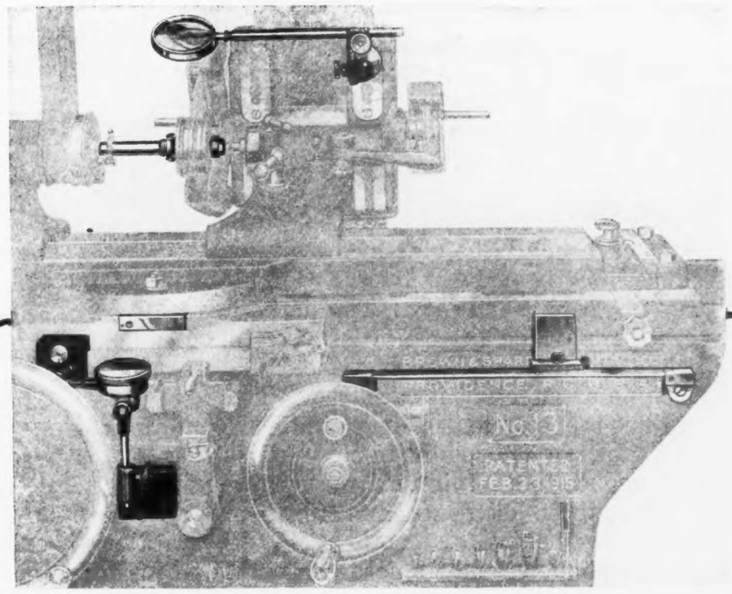


THE job illustrated above is typical of the special production set-ups designed and built by Screw Machine Engineering Service. The piece, an aluminum gear, is accurately cut with the use of a special hobbing attachment mounted on the rear cross slide and fed to the work by a cam.

The machine used is a Brown & Sharpe "High Speed" Automatic and a highly satisfactory production of accurate gears is obtained.

The work of the Brown & Sharpe Screw Machine Engineers is based on a long experience gained in planning and building thousands of production set-ups. They are always ready to help you with the puzzling production problems that frequently arise and to show you how to get the most out of the modern Brown & Sharpe Screw Machines. Ask our representative to tell you more about this Service.

problems— Engineering Sharpe Machines

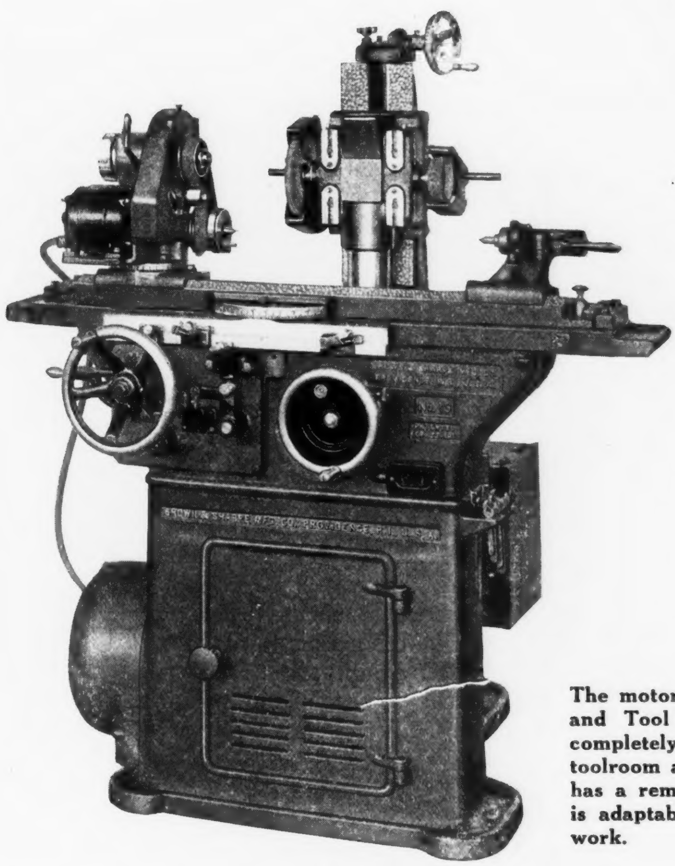


Circular Forming Tool Grinding Equipment developed by our grinding engineers to meet the requirements of screw machine users

OUR grinding machine engineers have met a pronounced need of the Screw Machine Toolroom by developing this Circular Forming Tool Grinding Equipment for use with the No. 13 Universal and Tool Grinding Machine.

The contours of Screw Machine Forming Tools and similar work can be quickly and accurately ground with this equipment. It is especially useful when extreme accuracy in the duplication of forms is desired—especially in high speed steel where turning is difficult. Greater accuracy of form assures longer life to the tool and produces better work.

Our representative will be glad to tell you about this equipment and the No. 13 Universal and Tool Grinding Machine with which it is used.



The motor-driven No. 13 Universal and Tool Grinding Machine is a completely self-contained unit for toolroom and general shop use. It has a remarkably broad range and is adaptable for a large variety of work.

BROWN & SHARPE

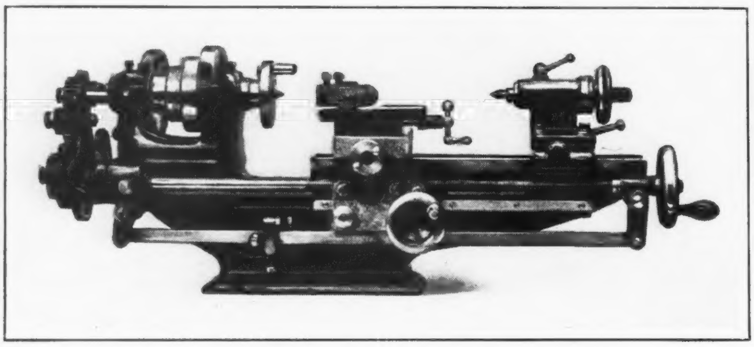
BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

being withdrawn too far from the bore while revolving and, likewise, prevent the grinder from striking the crankshaft or bearing lugs when it is moved downward. The entire fixture is arranged for a quick set-up. The bracket will take any 5/8- or 7/8-inch portable electric drill.

DRUMMOND BENCH LATHE

A Drummond bench lathe of 7-inch swing is being introduced on the market by the Gerold Co., 120 Liberty St., New York City. This lathe has a cantilever bed for which the claim is made that it may be bolted down to any bench without distorting the machine or affecting its accuracy. The bed has a large flat-top way and a long guiding front way. The lead-screw is brought in close under the front way to reduce to a minimum any "wringing" action between these elements and to insure a steady saddle movement.

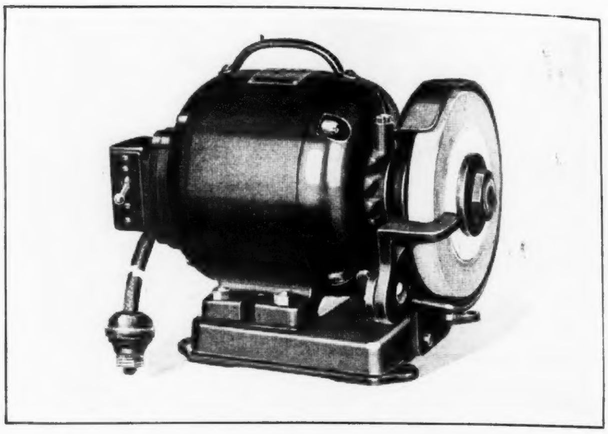
The spindle is hollow, and its nose has ten U. S. standard threads per inch. It is equipped with ball thrust bearings and runs in adjustable phosphor-bronze bearings. A spindle and cone pulley lock eliminate the use of nuts, screws, or wrenches. The spindle nose has a square ground shoulder which registers behind the thread to insure true running of faceplates and chucks.



Drummond Bench Lathe

A particular feature of the machine is a patented tool-holder. The holder itself is clamped to a pillar on the top slide, so that all clamping stresses are confined to the holder, only the normal cutting stresses being carried by the top slide. The tool-holder is quickly adjusted to suit turning or boring operations, and has a complete range of movements. A height adjustment of the tool relative to the centers is furnished, whereby the cutting rake and clearance of the tool remain constant for all settings and the tool does not change its angle in relation to the slides.

The lead-screw is equipped with a clutch by means of which the carriage can be stopped either by hand or automatically at any desired point. The slide rest is fully compound, and the cross-slide comprises a T-slotted boring and milling table which gives the machine flexibility for handling a large variety of work. The cross-slide screw is fitted with a micrometer index, and the top slide is furnished with a graduated base. U. S. standard threads from 8 to 40 per inch can be cut. There is a complete range of accessories, including an indexing, milling, and gear-cutting attachment, grinding and sawing attachments, various rests, a collet attachment, etc.



Motor-Grinder Made by the Master Electric Co.

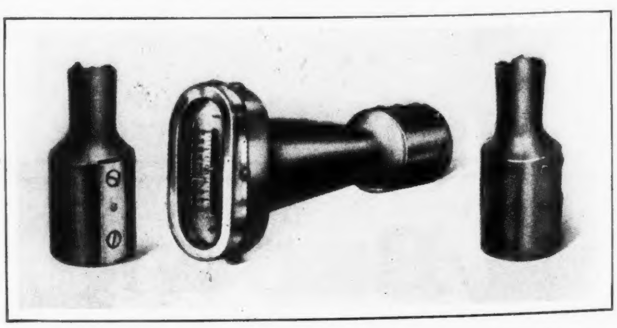
COMBINATION MOTOR AND GRINDER

In many small shops or service stations where there is only a small amount of grinding to be done, there is also frequently need for power to drive a small machine. To meet this need, the Master Electric Co., Linden and Master Ave., Dayton, Ohio, has built the small motor-driven grinder here illustrated, which is equipped with a pulley on the motor shaft between the grinding wheel and the motor. A belt applied to this pulley can be used for driving a small drilling machine, lathe, jig saw, etc.

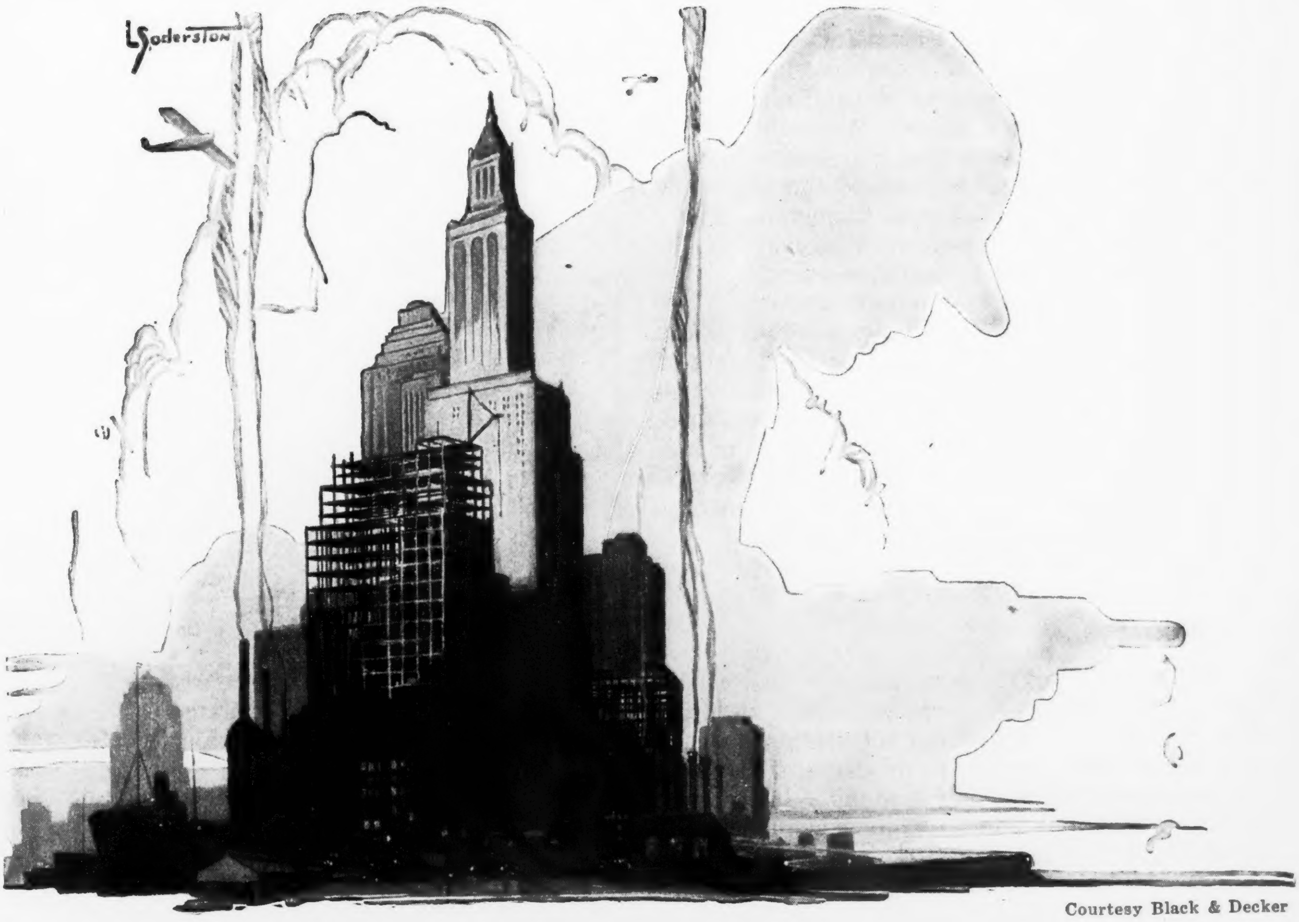
A one-quarter horsepower split-phase motor, which receives current from an ordinary lamp socket is usually provided, but direct-current motors for either 32-, 115-, or 230-volt current can be furnished when necessary. The motors have self-aligning phosphor-bronze bearings and splash-proof guards. The grinding wheel is 6 inches in diameter by 3/4 inch thick.

"CYLINDERMETER"

An automatic indicating self-aligning limit plug gage known as the "Cylindermeter" has recently been placed on the market by the Production Gauge Co., 2019 Fletcher St., Chicago, Ill., to furnish a simple, fast, and flexible means of measuring internal diameters of machine-finished parts. The user of this device can tell at a glance whether a hole is of the correct size, round, tapered, or straight, and how much it varies from specified dimensions. The device is simply plugged into the bore and turned around, the dial registering the trueness. As the "Cylindermeter" is drawn in and out, it registers any taper.



"Cylindermeter"—a Self-aligning Indicator Plug Gage

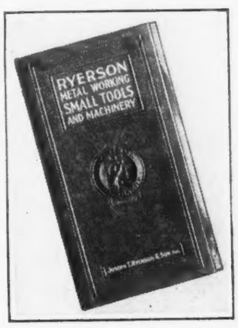


Courtesy Black & Decker

Tools for all Industrial Enterprise

A thousand and one small tools—for builders, machinists, manufacturers and all others who use metal-working equipment—can be ordered direct from our new Small Tool and Machinery Catalog, without delay or chance of loss.

No need to shop around for this type of equipment—the acknowledged leaders in each field are shown and described fully. Prices and F.O.B. points are in the supplement which goes with each catalog. And the Ryerson Guarantee on page one protects you as to both price and product, giving you the privilege of returning the shipment without question if everything is not right.



If you use metal-working tools of any kind; electric drills, grinders, saws, hammers, files, vises, riveters, punches and dies, wrenches, drills, forges, hoists, sheet metal working tools, etc., write and we will be glad to mail a copy. Ask for Catalog No. 27.

JOSEPH T RYERSON & SON INC.

Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Pittsburgh, Philadelphia, Boston, Jersey City, New York, Richmond, Houston, Tulsa, Los Angeles, San Francisco, Denver, Minneapolis, Duluth.

RYERSON MACHINERY

for **Machine Shops** | **Plate Shops** | **Structural Shops** | **Sheet Metal Shops** | **Railroad Shops** | **General Manufacturers**

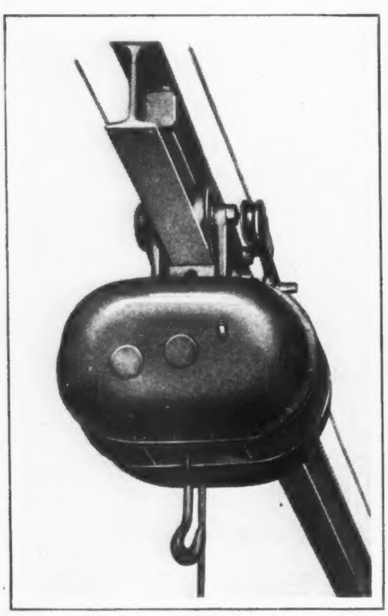
A standard outside micrometer may be used to check the device, as the gaging points are directly opposite each other. The "Cylindermeter" has limit indicators which can be set and changed at will by simply turning a screw. Any combination of limits up to 0.018 inch plus and minus may be obtained. Interchangeable contact shoes provide for measuring bores of different diameters. There is an adjustment for resetting the gage in the event that the gage point becomes worn.

The main body is an aluminum casting. The stationary contact is made of high-speed steel, and is ground and lapped. It extends the full length of the plug end of the body and can be readily removed when adapting the device to the measurement of holes of a different diameter. Spring ball plungers are located in three rows opposite the stationary contact shoe. The balls cause the stationary contact to align itself with the bore.

The movable contact is a tool-steel plunger, mounted in a hardened sleeve which is inserted in the body directly opposite the center line of the stationary contact shoe. This movable contact is forced outward at all times by the lower leg of the indicator lever which, in turn, is acted upon by a spring plunger directly behind the stationary contact. Any change in the size or shape of the hole being measured will cause this plunger to move in and out, and the amount of movement will be magnified and recorded on the dial at the upper end of the gage. The short leg of the indicator lever is actuated directly by the movable contact, while the long leg, which is fastened at the end to the pointer, multiplies the movement so that a 1/32-inch movement on the dial equals a 0.001-inch movement of the contact point.

"QUICK-LIFT" QUARTER-TON ELECTRIC HOIST

An all-steel quarter-ton electric hoist known by the trade name of "Quick-Lift" has recently been brought out by the American Engineering Co., Philadelphia, Pa. This is a high-speed hoist having a pressed-steel frame, chrome-manganese steel gears and shafts, ball bearings, a non-spinning hoisting rope, oil-bath lubrication, a push-button control, and upper and lower limit switches. All working parts are fully enclosed.



"Quick-Lift" Electric Hoist

The hoist weighs 200 pounds, and is made in plain-trolley and hook-suspension types. The former requires 16 inches of head room, and the latter, 18 inches. This hoist was shown at Cleveland in connection with the exhibit of the Gisholt Machine Co.

Union Renewable-tooth Chain Sprockets

RENEWABLE-TOOTH CHAIN SPROCKETS

With a view to reducing the maintenance cost of chain sprockets, the Union Chain & Mfg. Co., Sandusky, Ohio, has developed a line of sprockets with renewable teeth. When the teeth become worn or broken, it is a simple matter to replace them, thus eliminating the necessity of throwing away sprockets. The body of each sprocket is a steel casting, while the teeth are made of a wear-resisting alloy steel. The sprockets are usually made for chains having a pitch greater than 3 inches. They are made in both split and solid types, although the latter type is most generally used, because of the permanent nature of such sprocket installations.

* * *

NEW SYSTEM OF MARKING WRENCHES

In the past it has been the general custom to stamp on the heads of drop-forged wrenches having fixed openings the size of the bolt, nut, or cap-screw that the corresponding opening would accommodate. Under this system, for instance, a wrench head having an opening 7/8 inch wide would be stamped 1/2 U. S.—5/8 Hex Cap—9/16 S. A. E. to indicate that the opening would receive the heads and nuts of 1/2-inch U. S. standard bolts, of 5/8-inch hexagon cap-screws and 9/16-inch S. A. E. standard cap-screws.

The new American standard bolts and nuts recently adopted would add still other markings to the list; consequently, the American Engineering Standards Committee has specified that wrenches shall be marked with the width across flats of the nuts, etc., which they are designed to fit. According to a statement issued by J. H. Williams & Co., Buffalo, N. Y., the principal makers of drop-forged wrenches have adopted this recommendation, and all their wrenches, with the exception of those on hand, will be marked hereafter with the size of opening only. J. H. Williams & Co. have printed a leaflet that tabulates the various bolts, nuts, and cap-screws accommodated by the different wrench openings as marked under the new system, and will be glad to send this leaflet to anyone interested.

PERSONALS

G. H. Fabian has been appointed sales manager of the Oilgear Co., Milwaukee, Wis.

R. H. McGredy has been appointed sales manager of the Lo-Hed Hoist Division of the American Engineering Co., Philadelphia, Pa.

W. R. Tomlinson, formerly vice-president of the Billings & Spencer Co., Hartford, Conn., has entered the employ of J. H. Williams & Co. as works manager of their Buffalo plant.

Marcus A. Curran, assistant to the vice-president of the Graybar Electric Co., has been elected vice-president and general manager of the Bryant Electric Co., Bridgeport, Conn.

J. A. Franklin, formerly of the industrial sales division of the Cincinnati office of the Westinghouse Electric & Mfg. Co., has been appointed Cincinnati district manager of the Kaestner & Hecht Elevator Co.

A. T. Kasley, formerly head of the research department of the South Philadelphia Works of the Westinghouse Electric & Mfg. Co., has been appointed consulting engineer in the engineering department at that plant.

O. K. Parmiter metallurgist for the Firth-Sterling Steel Co., McKeesport, Pa., delivered an address on new stainless and alloy steels at the Golden Gate Chapter of the American Society for Steel Treating, San Francisco, Cal., on October 14.

Paul Hecht, of the South Philadelphia Works of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., has been appointed assistant to the vice-president. Mr. Hecht has been connected with the Westinghouse organization since 1905.

R. A. McDowell, of the Reliance Electric & Engineering Co., Cleveland, Ohio, who was formerly located at Pittsburg, Pa., has been made district manager at Cincinnati. C. D. Herbert, formerly at Syracuse, has been made district manager at New York City.

James R. Murphy, formerly with the S K F Ball Bearing Co., New York City, and the E. W. Bliss Co., Brooklyn, N. Y., has become associated, in the capacity of machine tool salesman, with the Triplex Machine Tool Co., 50 Church St., New York City, machinery dealers.

Gregory J. Comstock, director of research for the Firth-Sterling Steel Co., McKeesport, Pa., is spending some time in the research department of Thomas Firth & Sons, Sheffield, England. Mr. Comstock will later visit other English and European steel and cutlery plants.

William E. Brown, manager of the central station department of the New York district of the General Electric Co., Schenectady, N. Y., has been appointed New York district sales manager of the company. Mr. Brown's headquarters will be at 120 Broadway, New York City.

Walter B. Zietz, for many years associated with the engineering and sales department of the Newton Machine Tool Works, Philadelphia, Pa., and later district sales manager for the Consolidated Machine Tool Corporation of America, has been appointed sales manager for the Jones Machine Tool Works, Inc., Philadelphia, Pa.

W. C. Stockberger, who has been with the National Lamp Works of the General Electric Co., Schenectady, N. Y., for the last seventeen years, having served for the last fifteen years as New York manager of the Banner and Allegheny Divisions and later as sales manager of the Federal Lamp Division, is now connected with Wiedenbach-Brown Co., Inc., 26 E. 22nd St., New York City.

Stewart M. Bunting, 111 Broadway, New York City, has gone into business as a manufacturers' agent and will deal in machine tools and allied equipment. He will also specialize in high-grade used equipment. Mr. Bunting was associated for over twenty-five years with the Niles-Bement-Pond Co., having served for many years as manager of that company's miscellaneous department.

A. W. Moseley, mechanical engineer of the Sloan Valve Co., 4300 W. Lake St., Chicago, Ill., recently won a contest conducted by the Power Transmission Association for a slogan, the winning slogan being "Drive Right," which was the unanimous choice of the judges. The final design and emblem embodying the slogan will be adopted by the Power Transmission Association at the annual meeting on December 7 at the Hotel Commodore, New York City.

H. Collier Smith, founder and former president of the Quickwork Co., St. Marys, Ohio, manufacturer of "Quickwork" rotary shears and other sheet and plate metal-working machinery, announces that he has personally purchased all the assets of the corporation and all the outstanding preferred and common stock. The business will hereafter be conducted under the name of H. Collier Smith.

R. L. Wilson, works manager of the East Pittsburg Works of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., has been promoted to the position of assistant to the vice-president and general manager, J. M. Hipple, manager of the motor engineering department, will take Mr. Wilson's place as works manager. Mr. Wilson has been an active worker in the electrical industry since 1893, when he joined the Westinghouse organization following his graduation from the Rose Polytechnic Institute. Mr. Hipple entered the employ of the Westinghouse organization upon graduating as an electrical engineer from the Ohio State University in 1898.

OBITUARY

Ernest W. Taylor, assistant treasurer of the L. S. Starrett Co., Athol, Mass., died September 14 as the result of a heart attack, after several months' illness. Mr. Taylor had been actively identified with the L. S. Starrett Co. for thirty years, and was well known by the many friends and business associates of the company.

TRADE NOTES

American Oven & Machine Co. has removed its general offices and factory to 615-625 S. California Ave., Chicago, Ill.

American Engineering Co., Philadelphia, Pa., has appointed George L. Drake agency sales supervisor for the Lo-Hed hoist division of the company.

Air Reduction Co., Inc., 342 Madison Ave., New York City, has purchased the oxygen plant, equipment, and entire business of the New England Compressed Gas Co., Boston, Mass.

Triplex Machine Tool Co., New York City, dealer in machine tools, is moving to larger offices on October 1 at the same address—50 Church St.—the new offices being Suites 1382 and 1383.

Automatic Nut-Thread Corporation has acquired a four-story factory building at 3617-3619 N. 8th St., Philadelphia, Pa., and started the manufacture of the "Threadnut" automatic nut tapping machines.

Hill Clutch Machine & Foundry Co., Cleveland, Ohio, has opened a metropolitan district office at 30 Church St., New York City, Room 528, of which Charles C. Phelps will be in charge as sales engineer.

New Departure Mfg. Co., Bristol, Conn., has established a branch engineering office at San Francisco, Cal. Elliott A. Allen has been appointed resident manager, with offices at 1812 Van Ness Ave., San Francisco.

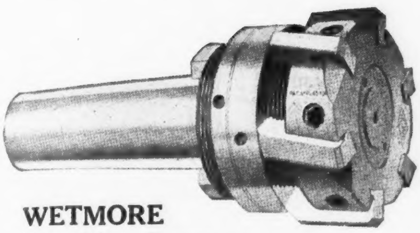
Cutler-Hammer Mfg. Co., Milwaukee, Wis., announces that its Cleveland office has been moved from the Guardian Trust Bldg. to the Guarantee Title Bldg., Suite 1905. The new office has approximately three times the space of the old.

Eclipse Interchangeable Counterbore Co., Detroit, Mich., is building an addition to its plant which will increase the floor space practically 100 per cent. With the additional machinery installed, there will be an increase in capacity from 50 to 70 per cent.

Morse Twist Drill & Machine Co., New Bedford, Mass., has opened a store at 92 Lafayette St., New York City, where a complete stock of high-speed and carbon drills, cutters, reamers, taps, dies, etc., will be carried, for the convenience of distributors, dealers, and users.

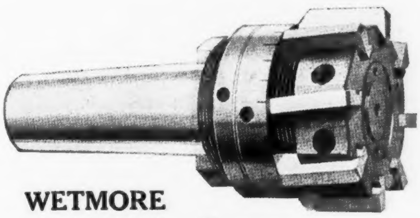
Michigan Machine Co., formerly located at 951 Porter Ave., Detroit, Mich., has moved to 2281 W. Fort St., Detroit. This move has the advantage of bringing the entire plant under one roof, and affords greater floor space, the new building having 27,000 square feet of floor space.

Falk Corporation, Milwaukee, Wis., manufacturer of herringbone gears, speed reducers, and flexible couplings, has appointed H. R. Harris, 1123 Metropolitan Life Building, Minneapolis, Minn., representative of the company, covering the state of Minnesota and Douglas County, Wisconsin.



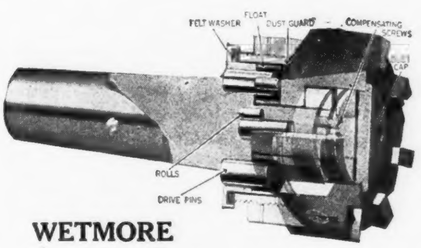
WETMORE
Roughing Reamer

—designed to withstand the initial reaming operation. Its blades are set at a right-hand angle. The sturdiness and rigidity of this tool enable it to remove an unusually large amount of stock.



WETMORE
Semi-finishing Reamer

—or intermediate tool, has left-hand angle blades, which eliminate "digging in" and chatter. Free cutting—a straight, round hole with no scoring when backing out after the cut, is the result—a condition ideal for the work of the Wetmore Finishing Reamer.



WETMORE
Finishing Reamer

Float-in-head design, with blades set at left-hand angle. Blades are held rigidly and are staggered to give a reaming action obtained by no other tool. This feature eliminates the need of grinding the cylinders. The most prominent feature of the Wetmore Finishing Reamer is the location of the float—in the head of the tool, where it belongs. Being in the head, directly under the strain, there is no tendency to get out of parallel and to "cramp". The float is an improved Oldham Float with rollers, but no sliding contact. This eliminates friction. The Wetmore mechanism is thoroughly protected from dust and grit, a cap covering the front and a washer protecting the back.

The bodies, cone and lock nuts of these reamers are of alloy steel, heat-treated.

Why Wetmore Cylinder Reamers Speed Production

Unusual *durability* and *sturdiness*, plus *greater working speed* and *less vibration*—that's the combination you get in these three adjustable Wetmore Cylinder Reamers!

Note the extreme ruggedness of the Roughing Reamer. The Semi-Finishing Reamer, with its left-hand angle blades, eliminates digging in and chattering. It assures a straight, round hole with no scoring. The construction of the Finishing Reamer assures a smooth, glass-like finish to the cylinder wall.

Wetmore Cylinder Reamers are standard in many of the largest motor manufacturing plants. A trial in your shop, in competition with other reamers, will prove that they save time and money.

Send for Catalog No. 26, showing full line of Wetmore Adjustable Reamers including standard, heavy-duty, shell, small machine, and cylinder reamers. Also arbors and replacement blades.

WETMORE REAMER COMPANY

60 27th Street, Milwaukee, Wis.

WETMORE ADJUSTABLE REAMERS

"THE BETTER REAMER"

Middleton, Eden & Co., Cleveland, Ohio, is an organization recently established to engage in engineering and sales executive work and industrial financing, particularly in the automotive industry. The firm consists of a partnership of Nathan A. Middleton and Charlton G. Eden of Cleveland.

Spun Steel Corporation, 2037 Dueber Ave., S. W., Canton, Ohio, has been organized for the purpose of making spun steel products from heavy gages of metal. The principal products are spun V-type belt pulleys, for which there is a demand in the automotive industries. F. G. Harrison is president and general manager.

Garman Tool & Die Co., 1414 E. Fort St., Detroit, Mich., has just completed an addition to the company's present shop. The new building is 100 by 110 feet, of modern fireproof construction. E. L. Garman is president and William J. Rogers, general manager. The firm specializes in the tool, die, and special machinery field.

Alliance Tank Co., Alliance, Ohio, which was organized in May, 1926, under the laws of the state of Ohio, for manufacturing steel tanks and miscellaneous plate work by means of the Lincoln "Stable-Arc" welding process, has just completed an all-steel factory, in the construction of which the electric arc welding process was utilized.

Brown Instrument Co., 4418 Wayne Ave., Philadelphia, Pa., announces the opening of a new branch office at 509 Mutual Bldg., Kansas City, Mo. The territory covered by this office will include the states of Kansas, Nebraska, the western part of Missouri, and the city of Council Bluffs, Iowa. F. M. Poole will be district manager.

Wade Engineering Co., of Los Angeles, Cal., who handle the products of the Lincoln Electric Co., Cleveland, Ohio, has moved its northern office from 69 Webster St., Oakland, to 533 Market St., San Francisco. The company has found larger space necessary owing to the increased demand for "Linc-Weld" motors and "Stable Arc" welders.

Timken Roller Bearing Co., Canton, Ohio and M. B. U. Dewar of London, England, have, together, purchased from Vickers, Ltd., all the capital stock of British Timken, Ltd. This purchase gives the Timken Roller Bearing Co. complete control throughout the world of the manufacture and sale of Timken bearings. Mr. Dewar will assume active management of the Timken interests in Great Britain.

Moltrup Steel Products Co., Beaver Falls, Pa., has discontinued its connection with the H. D. Cushman Co., 2100 B. F. Keith Bldg., Cleveland, Ohio, who formerly represented the company in the Cleveland territory. The Cleveland office (409 Union Bldg., Cleveland, Ohio) is now handled directly by the company, with S. D. Wallace in charge as district sales manager.

Triangle Tool & Pattern Co. has moved from 63 Brady St., Detroit, Mich., to new quarters at 12245 Turner Ave. The new building is of modern construction, fireproof throughout, and has 5000 square feet of available floor space. The company has added to its regular line of contract machine work a line of ball bearings, which it is manufacturing under the trade name of PBF line.

Smith Power Transmission Co., Cleveland, Ohio, has moved its offices from 1218 Ontario St. to larger quarters at 437 Penton Bldg. The company will continue to represent the Whitney Mfg. Co., Hartford, Conn., F. Raniville Co., Grand Rapids, Mich., the Ton-Tex Corporation, New York City, the Compressed Spruce Products Co., West Orange, N. J., and the Thermoid Rubber Co., Trenton, N. J.

Alexander Milburn Co., 1416-1428 W. Baltimore St., Baltimore, Md., manufacturer of welding and cutting apparatus, portable carbide lights, oil burners and preheaters, and paint and lacquer spraying equipment, has organized an office in Boston to be known as the Alexander Milburn Sales Co., Wiggin Terminals Building, 50 Terminal St., Boston, Mass. This office will be under the supervision of M. B. Crouse and G. B. Malone.

Brown Hoisting Machinery Co., Cleveland, Ohio, announces that at the last stockholders' meeting, the plan for the merger and consolidation of the company with the Industrial Works, of Bay City, Mich., was approved. The stockholders of the latter company have also approved the merger. The name of the new company is the Industrial Brownhoist Corporation, and the general offices are in Cleveland. Alexander C. Brown is president.

Westinghouse Electric International Co. has established a new branch to be known as the Compania Electrica Westinghouse de Chile, with activities in the countries of Chile and Bolivia. E. L. McCloskey, formerly manager for China of the Westinghouse Electric International Co., has been appointed manager of the new branch, with headquarters at Santiago, Chile. Mr. McCloskey has been connected with the Westinghouse organization since 1905.

New York Blue Print Paper Co., 96 Reade St., New York City, has changed its name to The Charles Bruning Co., Inc. Owing to the fact that the business has expanded since its inception to include engineers' and architects' supplies, instruments, and equipment and drafting-room furniture, the change of name was considered desirable. This company has recently acquired the blueprint paper coating and materials departments of the Rapid Blue Print Co. of Los Angeles, Cal.

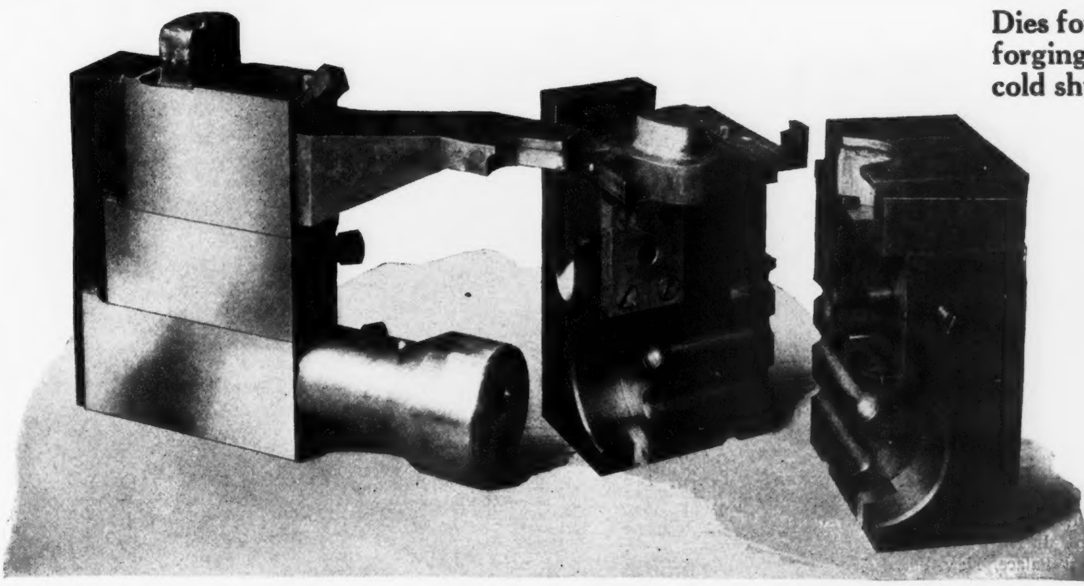
Electric Arc Cutting & Welding Co., 152-158 Jelliff Ave., Newark, N. J., announces that the Seneca Electric Welder Sales Corporation, Detroit, Mich., the Welding Service, Inc., San Francisco, Cal., the Gibb Welding Machines Co., Bay City, Mich., the Allan Mfg. & Welding Co., Buffalo, N. Y., and the Weldrite Co., Detroit, Mich., have obtained licenses to operate under the Holslag-Arendt patents. F. C. Owen of the Owen Electric & Mfg. Co., Fayetteville, N. C., and the Electric Arc Cutting & Welding Co., the owners of the Holslag-Arendt patents, are also licensed users of these patents.

Cincinnati Grinders, Inc., Cincinnati, Ohio, has recently completed the preparation of four films, showing views of installations of cylindrical grinders in leading plants in this country and abroad. These films are available to all educational institutions and to apprentice schools and foremen's clubs, as well as engineering societies. The company will provide a special lecture, giving complete technical discussion of the film, if desired. These are not moving pictures, but a series of still pictures, so that ample time may be taken to become thoroughly familiar with each view. Those interested may obtain these films from the Publicity Department of Cincinnati Grinders, Inc.

Thompson-Owens Corporation, Toledo, Ohio, has recently been incorporated for the manufacture of finished bronze bushings and bearings, and brass and bronze castings. A modern plant, including foundry, located on the Toledo Terminal Railroad, has been acquired at the corner of York and Wheeling Sts. George Thompson, president and general manager, who will have charge of all production, has been for the last ten years with the Bunting Brass & Bronze Co. in the capacity of general superintendent and works manager. J. E. Owens, secretary treasurer and sales manager, was connected with the Bunting Brass & Bronze Co. for fourteen years as salesman and sales manager.

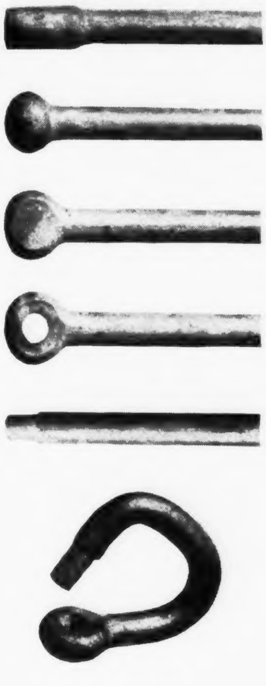
Foote Bros. Gear & Machine Co., 232-242 N. Curtis St., Chicago, Ill., announces that the company has purchased the A. Plamondon Mfg. Co. of Chicago, thus merging two pioneer industrial firms, both with a history extending back into the early days of Chicago's industrial growth and both engaged in the manufacture of gearing and power transmission equipment. The A. Plamondon Mfg. Co. was organized in 1859. The present plan of the company comprises a modern machine shop, pattern shop, and foundry housed in a factory building 500 by 125 feet, located at 5301 S. Western Blvd., Chicago, Ill. The plant will continue to be operated as in the past. The personnel of the old organization will be retained.

Skinner Chuck Co., New Britain, Conn., at a recent meeting of the board of directors appointed E. J. Skinner chairman of the board. Mr. Skinner, together with his father, J. N. Skinner, organized the company in 1887, at which time he was elected secretary. In 1912 he was made assistant treasurer, as well as secretary. In 1915 he was elected vice-president, and upon the death of Charles Glover, in 1923, was chosen president, which office he has held up to the present time. S. W. Parsons, formerly of the Stanley Works, will become president. Mr. Parsons has been connected with the Stanley Works for the last twenty-three years. The other officers of the company are Paul K. Rogers, vice-president and treasurer; A. A. North, vice-president; R. B. Skinner, secretary and sales manager; and A. E. Thornton, assistant secretary. The Skinner Chuck Co. is adding to its line of lathe, drill, and planer chucks a line of air chucks, cylinders, and air holding devices.



Dies for forging cold shut.

SIX OPERATIONS:—all in a $1\frac{1}{2}$" AJAX Machine



THE production of the logging chain cold shut illustrated is an interesting example of the variety of processes a modern Upsetting Forging Machine can perform.

The necessary stock for the eye is first ***upset*** into a ball in two blows; next the ball is ***flattened*** between the faces of the dies, and then the hole for the eye is ***punched.***

The tong hold is reversed and the opposite end is ***swaged*** to smaller diameter to enter the hole and in a final operation the piece is ***bent,*** all at one heat.

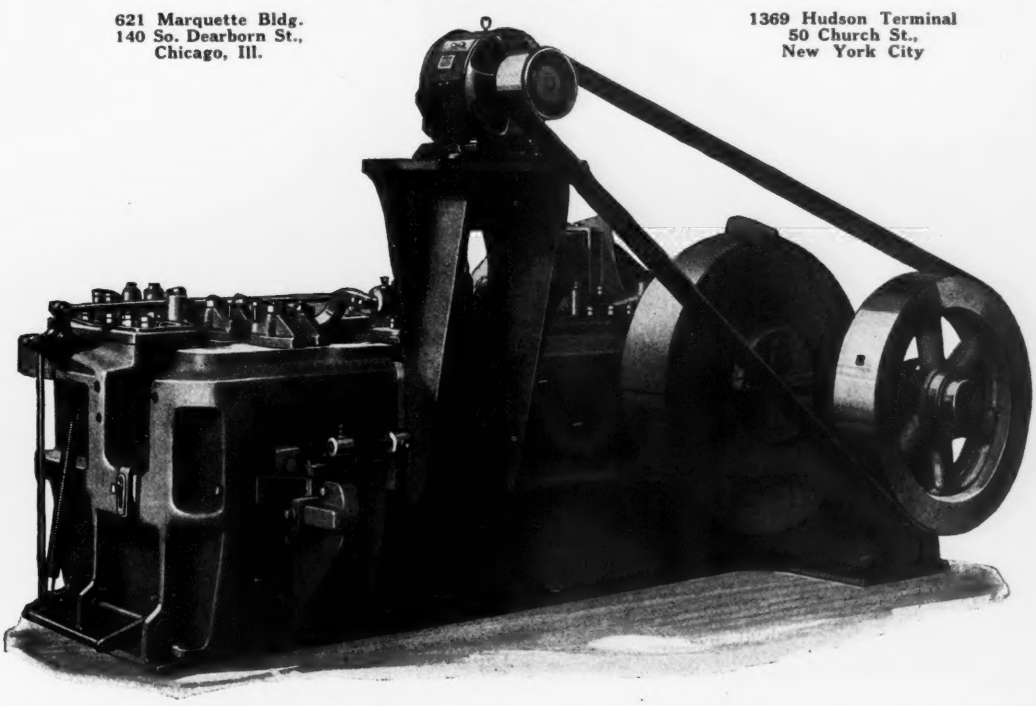
Seldom such a variety of operations enters into the making of a forging, but with all possible processes in mind Ajax Engineers will be glad to assist you in speeding up your production and reducing your production costs.

THE AJAX MANUFACTURING CO.

EUCLID BRANCH P. O., CLEVELAND, OHIO

621 Marquette Bldg.
140 So. Dearborn St.,
Chicago, Ill.

1369 Hudson Terminal
50 Church St.,
New York City



$1\frac{1}{2}$" Ajax Heavy Duty Upsetting Forging Machine

COMING EVENTS

NOVEMBER 14-16—World motor transport congress in London, England. Further information can be obtained from the Society of Automotive Engineers, 29 W. 39th St., New York City.

NOVEMBER 17-26—Commercial motor transport exhibition in London, England. Further information can be obtained from the Society of Automotive Engineers, 29 W. 39th St., New York City.

DECEMBER 1—Tractor and stationary engine meeting of the Society of Automotive Engineers at the Hotel Sherman, Chicago, Ill. Secretary's address, 29 W. 39th St., New York.

DECEMBER 5-9—Annual meeting of the American Society of Mechanical Engineers at the society's headquarters, Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary.

DECEMBER 5-10—Sixth national exposition of power and mechanical engineering at Grand Central Palace, New York City. Address inquiries to International Exposition Co. Grand Central Palace, New York City.

DECEMBER 7—Annual meeting of the Power Transmission Association in Tavern Room C, Hotel Commodore, New York City, at 10 A. M. W. S. Hays, executive secretary, 644 Drexel Bldg., Philadelphia, Pa.

FEBRUARY 14-17, 1928—Third Mid-west power conference to be held in Chicago, Ill., under the auspices of nine national and local engineering societies, including the Chicago Section of the American Society of Mechanical Engineers. Fred B. Orr, secretary-treasurer, Room 1136, 72 W. Adams St., Chicago, Ill.

MAY 14-18—Twenty-first annual exhibit of machines, equipment, materials and supplies for foundries and the allied industries in the Commercial Museum, Philadelphia, Pa. In conjunction with the exhibit, the thirty-second annual convention of the American Foundrymen's Association will be held. C. E. Hoyt, manager of exhibits, 140 S. Dearborn St., Chicago, Ill.

SOCIETIES, SCHOOLS AND COLLEGES

RENSSELAER POLYTECHNIC INSTITUTE, Troy, N. Y. Bulletin descriptive of the research work conducted at the institute.

OHIO MECHANICS INSTITUTE, Central Parkway and Walnut St., Cincinnati, Ohio. Catalogue for 1927-1928, containing calendar, description of courses, etc.

POLYTECHNIC INSTITUTE OF BROOKLYN, Livingston and Court Sts., Brooklyn, N. Y. Seventy-second annual catalogue of the College of Engineering 1927-1928.

NATIONAL SUPPLY & MACHINERY DISTRIBUTORS' ASSOCIATION, 505 Arch St., Philadelphia, Pa. Circular outlining the character and scope of the association.

NEW BOOKS AND PAMPHLETS

ELECTRICAL MACHINERY APPARATUS AND SUPPLIES. 18 pages, 6 by 9 inches. Published by the Department of Commerce, Washington, D. C. (Census of Manufactures, 1925) Price, 5 cents.

KINEMATICS OF GEROTORS. A discussion of the design of a new type of rotary engine. By Myron F. Hill. 44 pages, 6 by 9 inches. Published by the Peter Reilly Co., 133 N. 13th St., Philadelphia, Pa.

CALIBRATION OF A DIVIDED SCALE. 15 pages, 7 by 10 inches. Circular of the Bureau of Standards No. 329. Obtainable from Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 10 cents.

YEAR BOOK OF THE AMERICAN ENGINEERING STANDARDS COMMITTEE (1927). 80 pages, 7 3/4 by 10 1/2 inches. Published by the American Engineering Standards Committee, 29 W. 39th St., New York City.

HEALTH HAZARDS OF BRASS FOUNDRIES. By John A. Turner and L. R. Thompson. 75 pages, 6 by 9 inches. Published by the United States Public Health Service, Washington, D. C., as Public Health Bulletin No. 157.

THE EFFICIENCY, STRENGTH, AND DURABILITY OF SPUR GEARS—Part 1. By William H. Rasche. 44 pages, 6 by 9 inches. Published as Bulletin No. 3 of the Engineering Experiment Station of the Virginia Polytechnic Institute, Blacksburg, Va.

OXWELDED ROOF TRUSSES. By H. H. Moss. 72 pages, 8 by 10 3/4 inches. Published by the Linde Air Products Co., 30 E. 42nd St., New York City.

This publication consists of a report of the design, development, fabrication, and testing of a series of oxy-acetylene welded roof trusses of the Fink type.

AMERICAN LUBRICANTS. By L. B. Lockhart, consulting and analytical chemist. 408 pages, 6½ by 9¼ inches. Published by the Chemical Publishing Co., Easton, Pa. Price, $5, postpaid.

This is the third edition of a book intended to assist the user and buyer of lubricants in an intelligent selection of oils and greases. The point of view throughout is that of the user rather than of the refiner. The book contains specifications and methods of testing a large number of oils and greases.

THE PRACTICAL ART OF GENERATING. 70 pages, 8½ by 10½ inches. Published by the Fellows Gear Shaper Co., Springfield, Vt.

This book is a simple and practical analysis of the generating principle as applied in machine shop practice, and gives numerous examples showing how it has been applied to advantage commercially in many different branches of the industry. The book is profusely illustrated, each subject dealt with being provided with explanatory engravings. Reference is made not only to the engineering of gear teeth, but to the generating of a great many other machine parts, such as clutch teeth, serrated steering arms and knuckles, splines, cams, and similar parts.

PURCHASING. By W. N. Mitchell. 385 pages, 6 by 8½ inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $4.50.

This is the first of a new group of volumes on business administration, the present book covering the subject of purchasing. As this is an important function in every business organization, the work should be of general interest. Basic purchasing policies are compared, and methods of coordination with other departments are discussed. The book covers, specifically, purchasing problems in their relation to company policy, as well as departmental organization, buying policies, and routine procedures, records, and reports. Particularly helpful chapters are those concerned with planning for normal requirements and with the purchase budget. Many forms and illustrations from practice are included.

MACHINE WORK. By Theron J. Palmateer. 202 pages, 5 by 8 inches. Published by the Stanford University Press, Stanford University, Cal. Price, $2.25, postpaid.

This is a concise shop manual and reference book on machine shop work. The book has been specifically designed in size and content to meet the needs of the school shop. The text is divided into two parts as follows: (1) Fundamentals in lathe work, drilling, planing, milling, and grinding; (2) quantity production work. In the first part detailed directions are given for making such pieces as mandrels, gears, faceplates, V-blocks, etc. The second part contains instructions for machining and assembling in quantities the sixteen parts of a hand-power grinder. In principle, the method of doing the work is the same as that used in small manufacturing shops, requiring no special automatic machines. The book is well illustrated throughout.

MACHINE DESIGN DRAWING-ROOM PROBLEMS. By C. D. Albert. 355 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 432 Fourth Ave., New York City. Price, $3.50.

This is the second edition of a book which is the outgrowth of the experience of the author in teaching machine design to engineering students in the College of Engineering, Cornell University. It presupposes a knowledge of kinematics, mechanics, and engineering drawing. The purpose of the work is to offer complete material for a drawing-room course in general machine design, and to that end, complete and comprehensive problems are presented. The text is divided into ten chapters as follows: General Reference Chapter; Materials; Factor of Safety and Allowable Stress; Pump Problem; Slide Valve and Valve Gear Diagrams; Steam Engine Flywheel; Combination Punch and Shear; Balancing Problem; Upright Drilling Machines; and Mechanical Features of Jib Crane.

CHEMICAL ENGINEERING CATALOGUE. (1927 edition). 1160 pages, 9 by 11¾ inches. Published by the Chemical Catalog Co., Inc., 419 Fourth Ave., New York City. Price, $10. (Special rates are made to chemical engineers, chief chemists of industrial and research laboratories, heads of chemical engineering departments of universities and schools, and technical departments of the United States and foreign governments and libraries.)

This is the twelfth annual edition of a work containing collected, condensed, and standardized catalogue data of equipment, machinery, laboratory supplies, heavy and fine chemicals, and raw materials used in the industries employing chemical processes of manufacture. The book also contains a classified index of such equipment and materials, with cross-references, as well as a technical and scientific book section, cataloguing and briefly describing a complete list of books in English on chemical and related subjects. The classified directory section of this volume contains listings of more than 2000 manufacturers, and should prove valuable to those interested in buying equipment or materials of this kind. The catalogue section is fully illustrated, and gives complete information concerning the products of the manufacturers listed.

CONDENSED CATALOGUES OF MECHANICAL EQUIPMENT (1927-1928). 1006 pages, 8½ by 11½ inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City. Price, $5 (issued free to members of the society).

This is the seventeenth annual edition of a work containing condensed catalogue data of mechanical equipment and a general classified directory. The present edition shows a gain over the previous one, having a total of 708 pages of catalogue data carried by 562 firms. There are over 3500 illustrations in the volume. The mechanical equipment directory has also increased in scope, containing over 42,000 separate listings. The three sections of the book are the same as in previous editions. The first section, containing classified catalogue data, comprises the principal section of the book. The general classified directory contains a specialized cross-indexed list of the mechanical equipment listed, together with the names and addresses of the manufacturers. The third section comprises a professional engineering service directory, containing a classified list of members of the American Society of Mechanical Engineers engaged in the various branches of professional engineering practice, together with condensed and illustrated catalogue information descriptive of the services of engineers in this field.

NEW CATALOGUES AND CIRCULARS

COMBINATION SQUARES. Union Tool Co., Orange, Mass. Circular illustrating a new type of combination square with a die-cast head, fitted with scriber and level.